VOLUPTAS

MASTER THESIS SPRING 2020

SYNERGY

DIEGO BAZZOTTI

SYNERGY

Humankind biggest power has always been the control over its habitat. The ability to shape the environment to our advantage is limited exclusively by our one-sided dependence on it. Being products of nature, we cannot override the laws that govern it.

Our society has always gone to great lengths to ensure that our energy needs are met. This objective has pushed the environmental concerns down the list of priorities. The harmful effects on the environment that these actions have produced are what we must address today in order to have a tomorrow.

This project stems from the desire and need for a synergistic interdependence between nature and us.

I

PERIMETER

The city of Basel is the second largest economic center in Switzerland, responsible for one third of the gross national product. Cross-border cooperation has provided the industrial sector with a qualified workforce at competitive costs, but has caused problems in the management of car traffic and an increase in pollution in the city. Political authorities try to mitigate environmental problems by promoting the transition from petrol to electric cars.

The efforts promoted by the municipality in the improvement and expansion of the network of public transport and cycle paths have been rewarded by a constant increase in users. This is further confirmed by the fact that only a tenth of the citizens of Basel use the car to go to the workplace. To further optimize this situation, a new road strategy is needed to capture the flow of incoming commuters, with the aim of redirecting it to the public transport network. This would limit the number of motorized vehicles in the city center and improve travel times on the public network.

A suitable place for the implementation of this project was identified in the Klybeck neighborhood, at the meeting point of the Germanic and French motorways. Inside the intervention perimeter of the soon-to-be Klybeckplus quarter, there are three parking units from the 1960s, designed by Suter + Suter for the former giant of the chemical industry CIBA. The buildings are located near many tram and bus lines that connect efficiently to the rest of the city. By equipping them with charging stations, commuters will have an incentive to park their electric cars there and continue their journey by public transport.


MULHOUSE | 35 KM | 30 MIN
FREIBURG | 70 KM | 50 MIN
FRENCH BORDER
GERMAN BORDER
ZURICH | 80 KM | 55 MIN
BASEL CITY

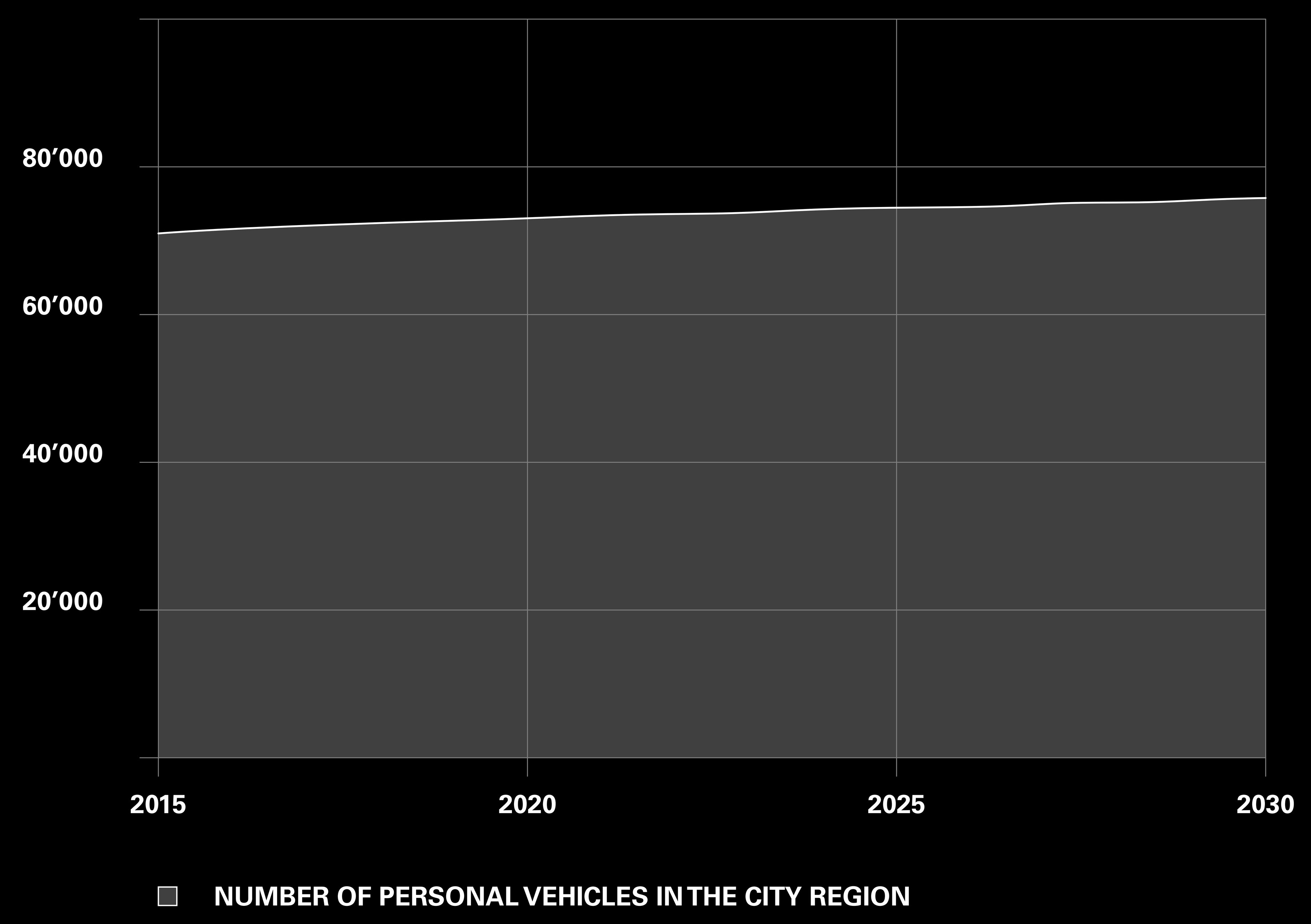

KLYBECK

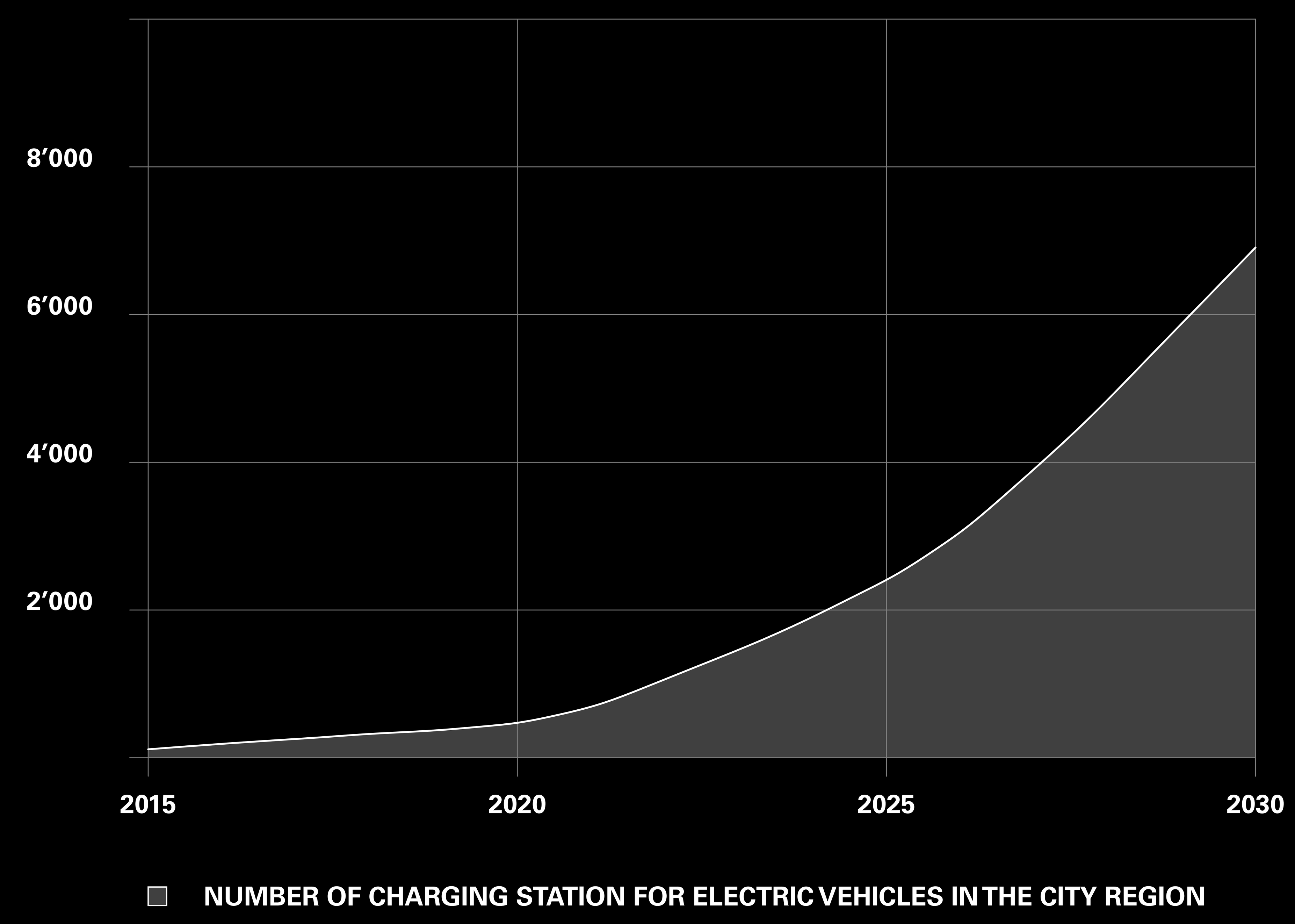

FRENCH BORDER
GERMAN BORDER
KLYBECKPLUS INTERVENTION PERIMETER


TO / FROM GERMANY
TO / FROM FRANCE
TO / FROM SWITZERLAND
HIGHWAYS


MAIN ROADS


PUBLIC TRANSPORT NETWORK

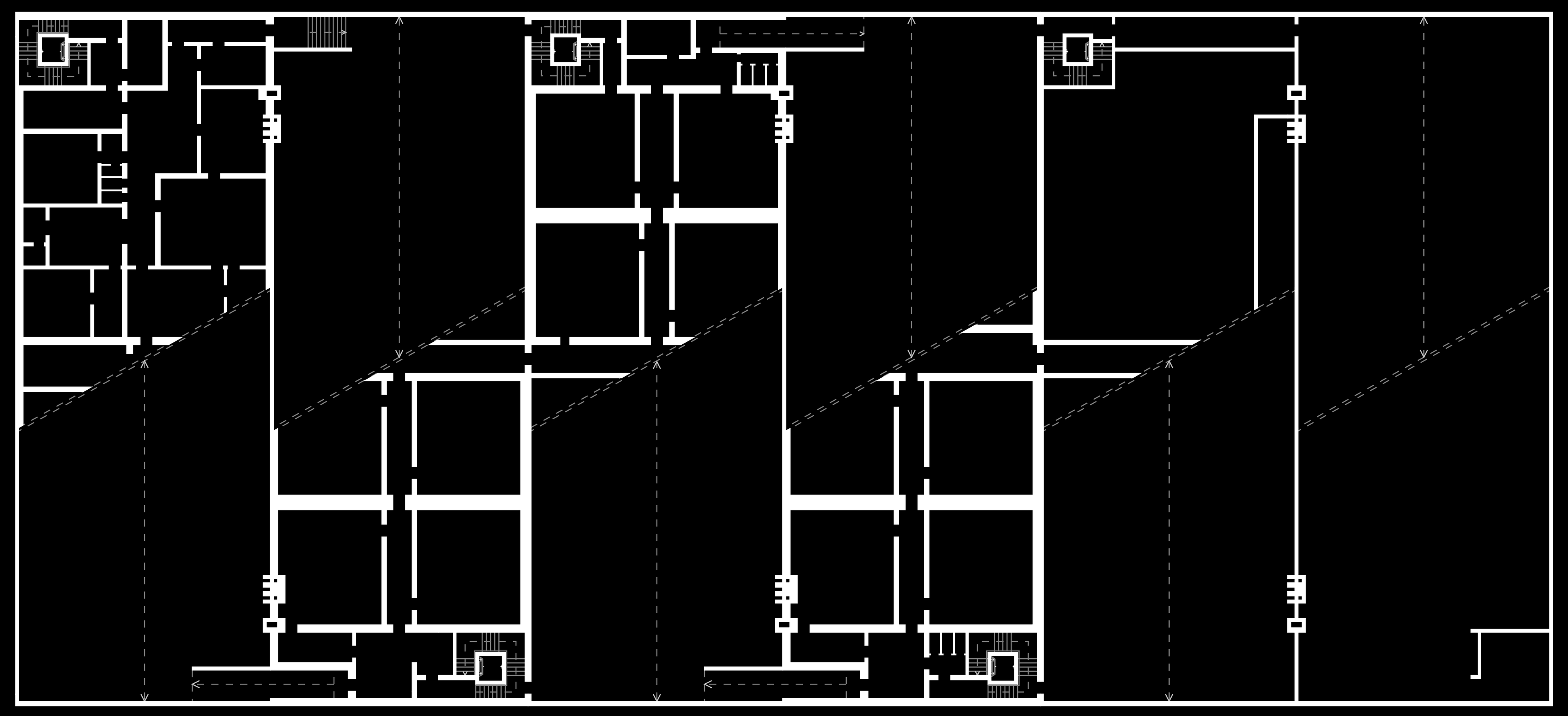




PROJECTED MOBILITY IN THE CITY


TRANSPORT HUB

SUTER + SUTER, CIBA PARKHAUS, 1963



UNDERGROUND LEVEL


GROUND LEVEL


FIRST TO THIRD LEVEL


FORTH LEVEL


ROOF LEVEL

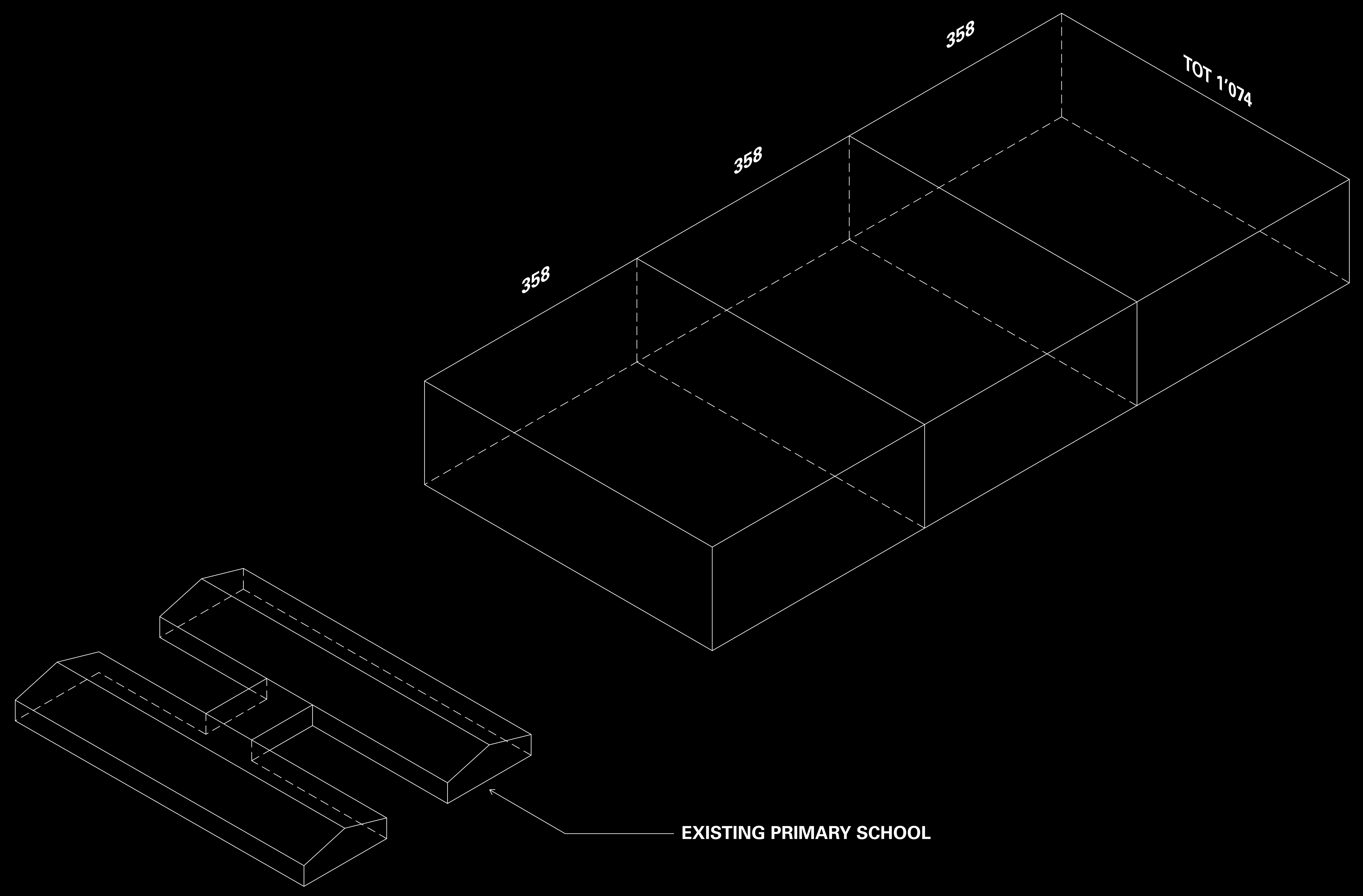
WEST SECTION

II

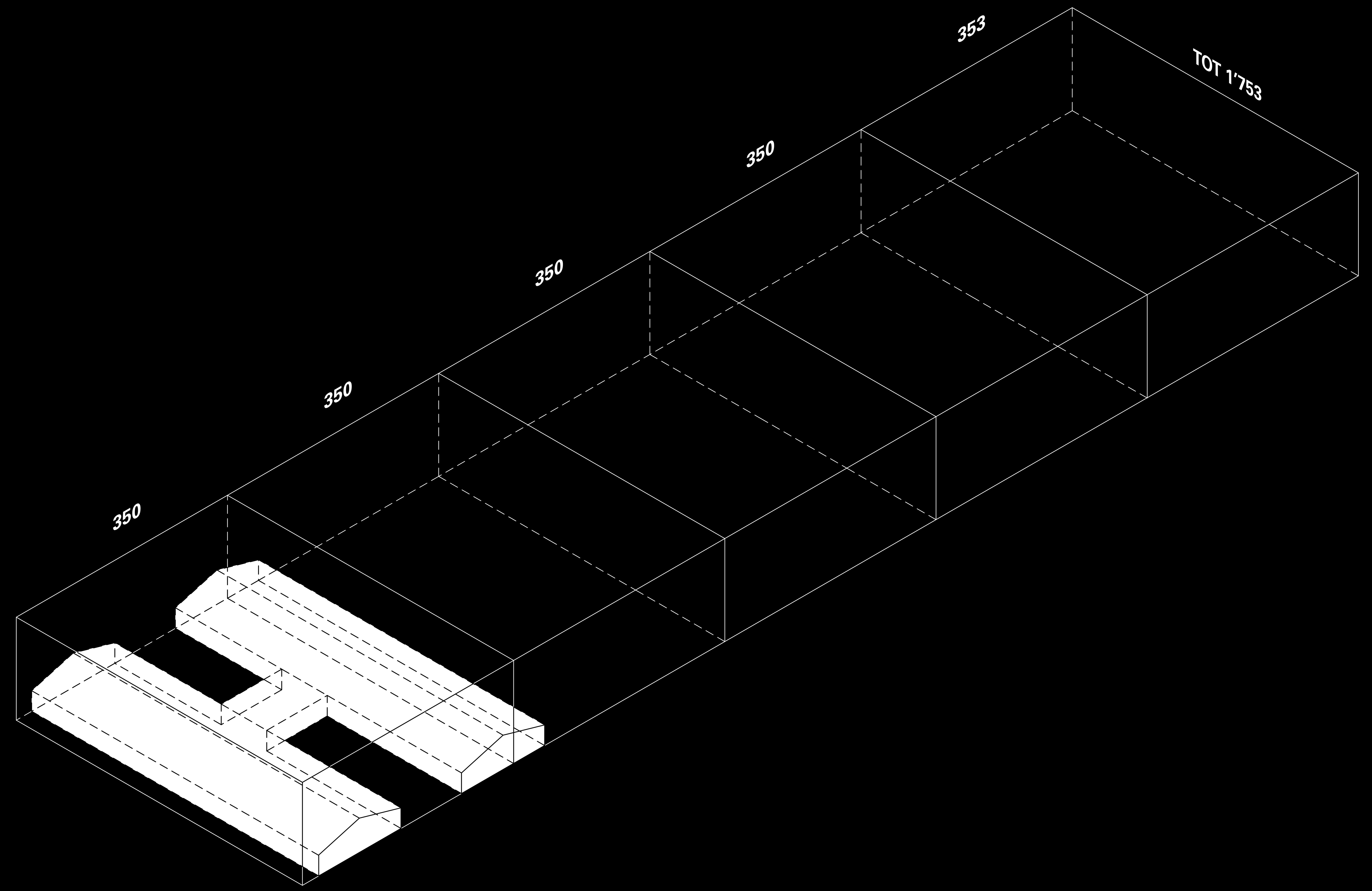
TRAFFIC

To cope with the number of vehicles, it is proposed to add two additional units, bringing the total capacity close to 1800 cars. This extension comes at the expense of the nearby primary school, which will be relocated on top of the five units.

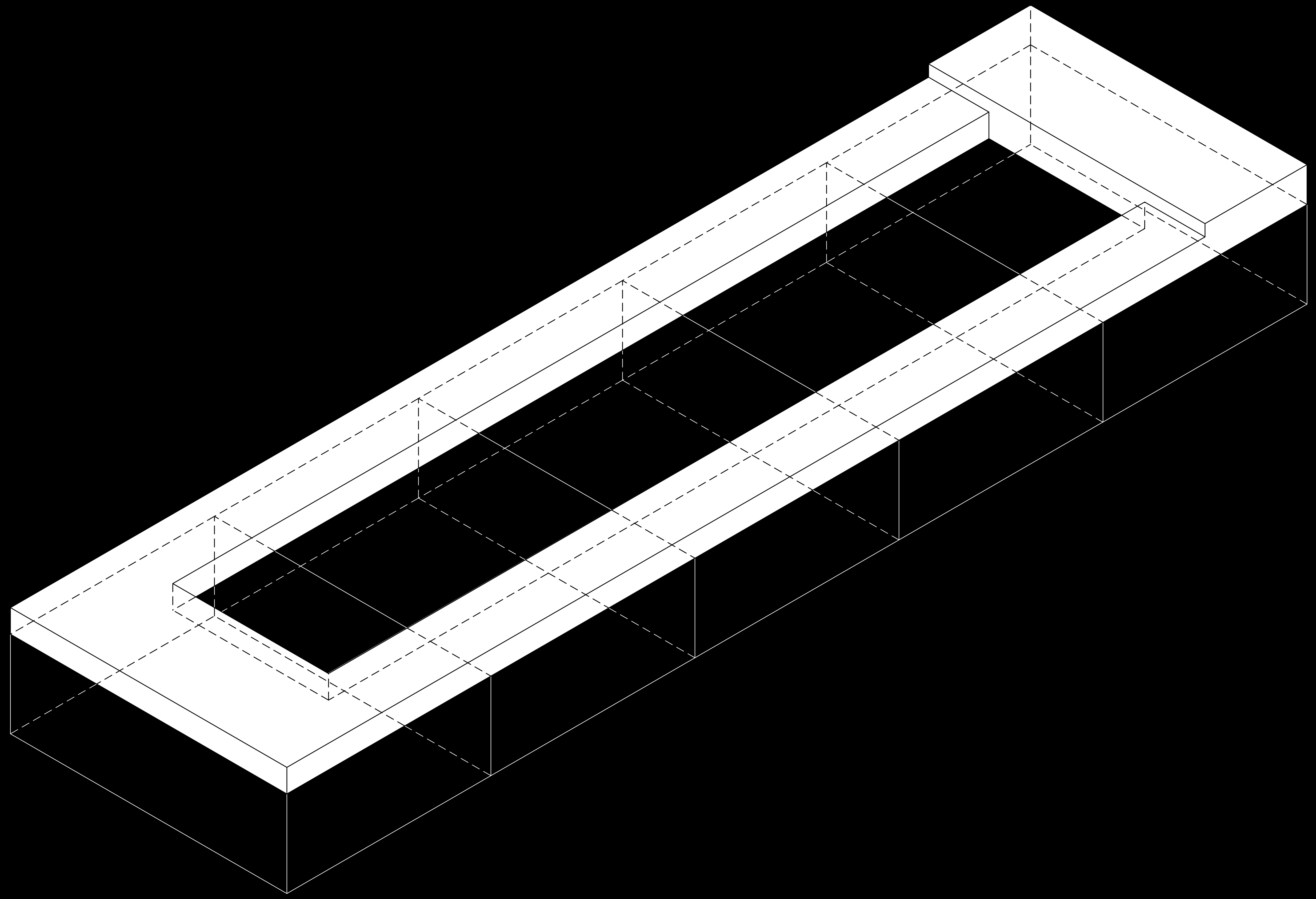
The internal organization will be modified in order to double the number of entries, thus making the incoming flow of vehicle more fluid. Each unit will be connected to its apex with the following to allow users to reach the western end, where paternoster-type elevators will bring them back to ground level. By exploiting the weight of the cars, it is possible to produce energy in a similar but inverse way to what is produced in the engine of a crane. Therefore, parked vehicles will reintroduce energy into the grid when they leave.



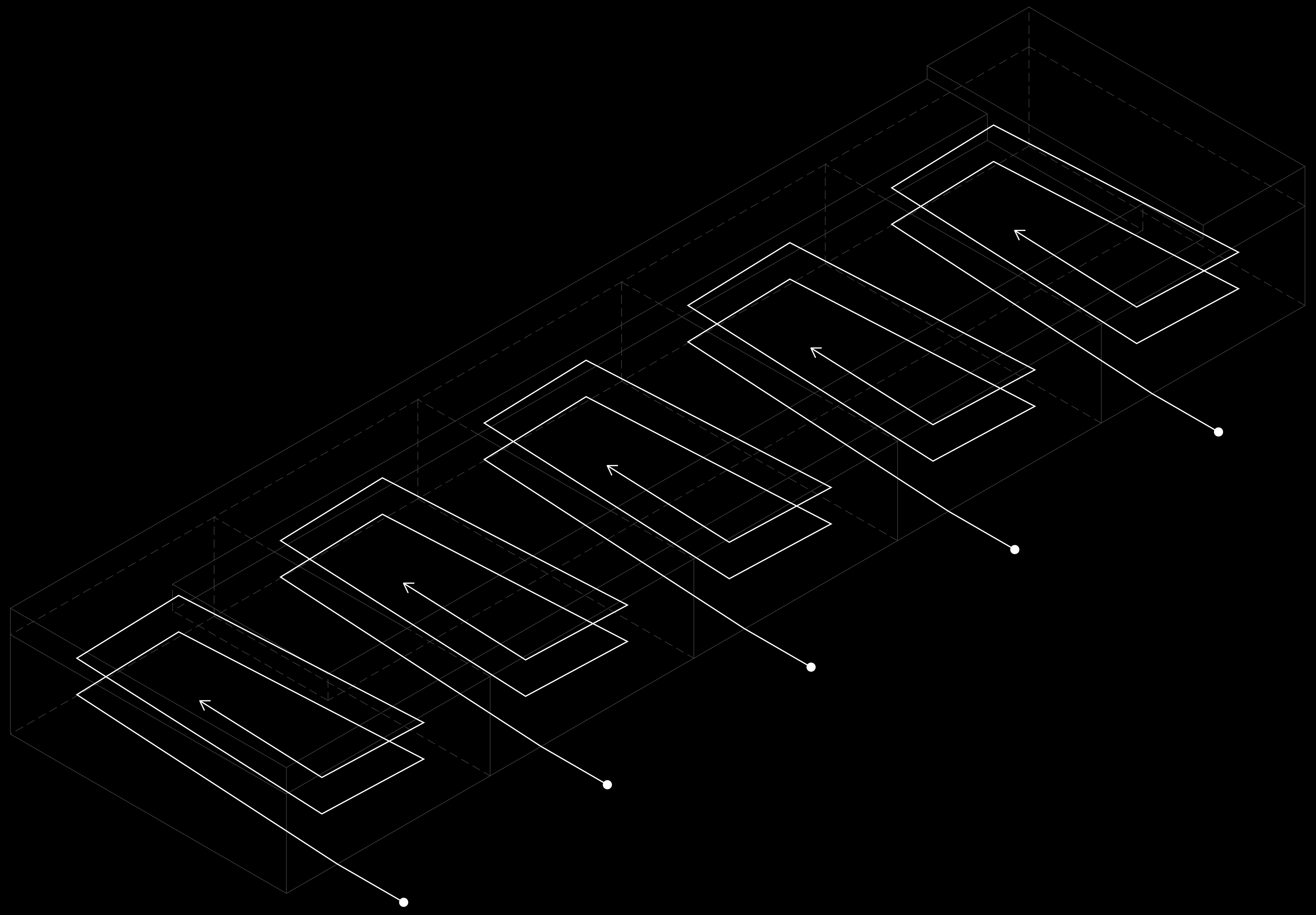
CURRENT CAPACITY



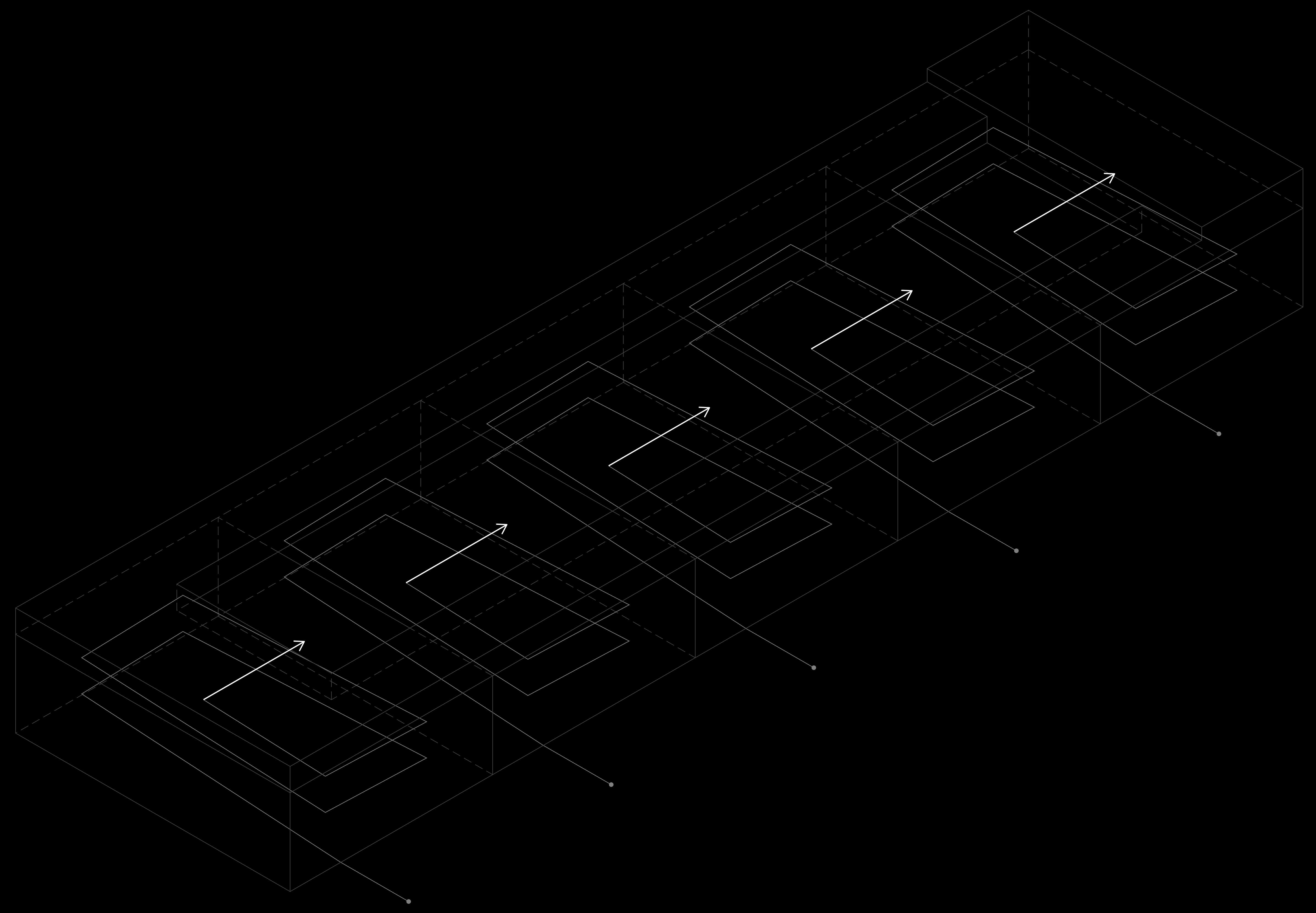
NEW CAPACITY

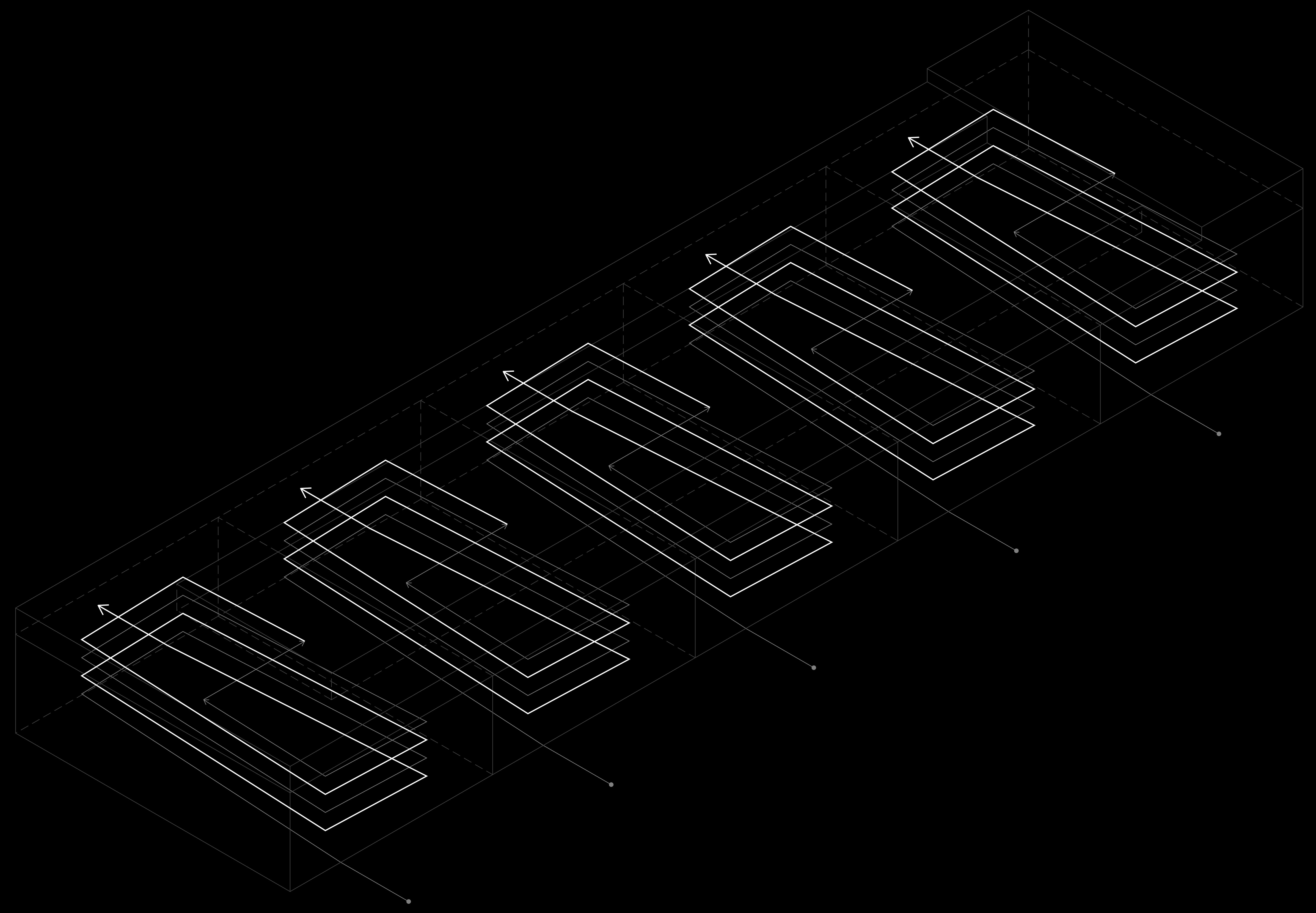


RELOCATION OF THE SCHOOL

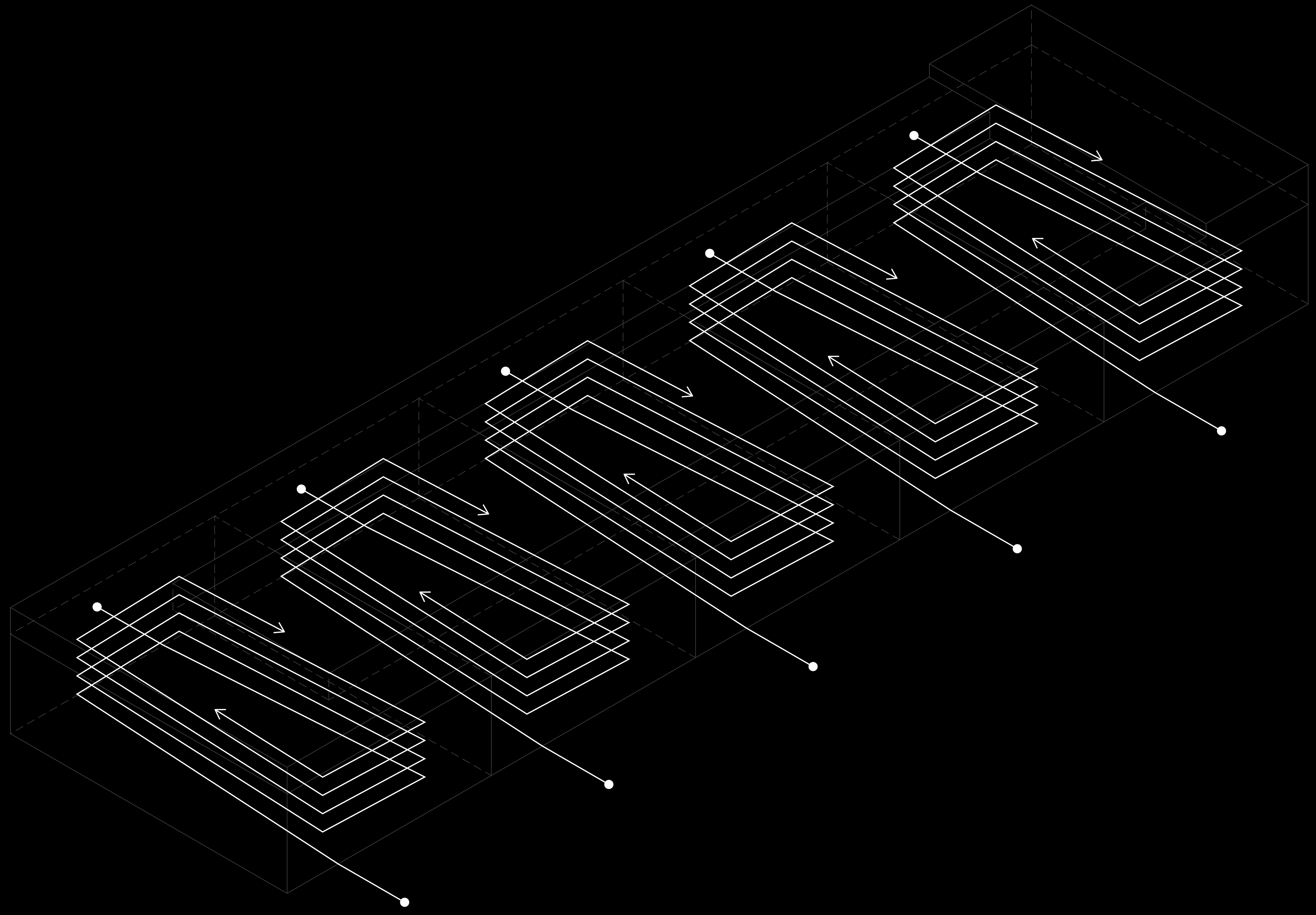


CURRENT ENTRANCES

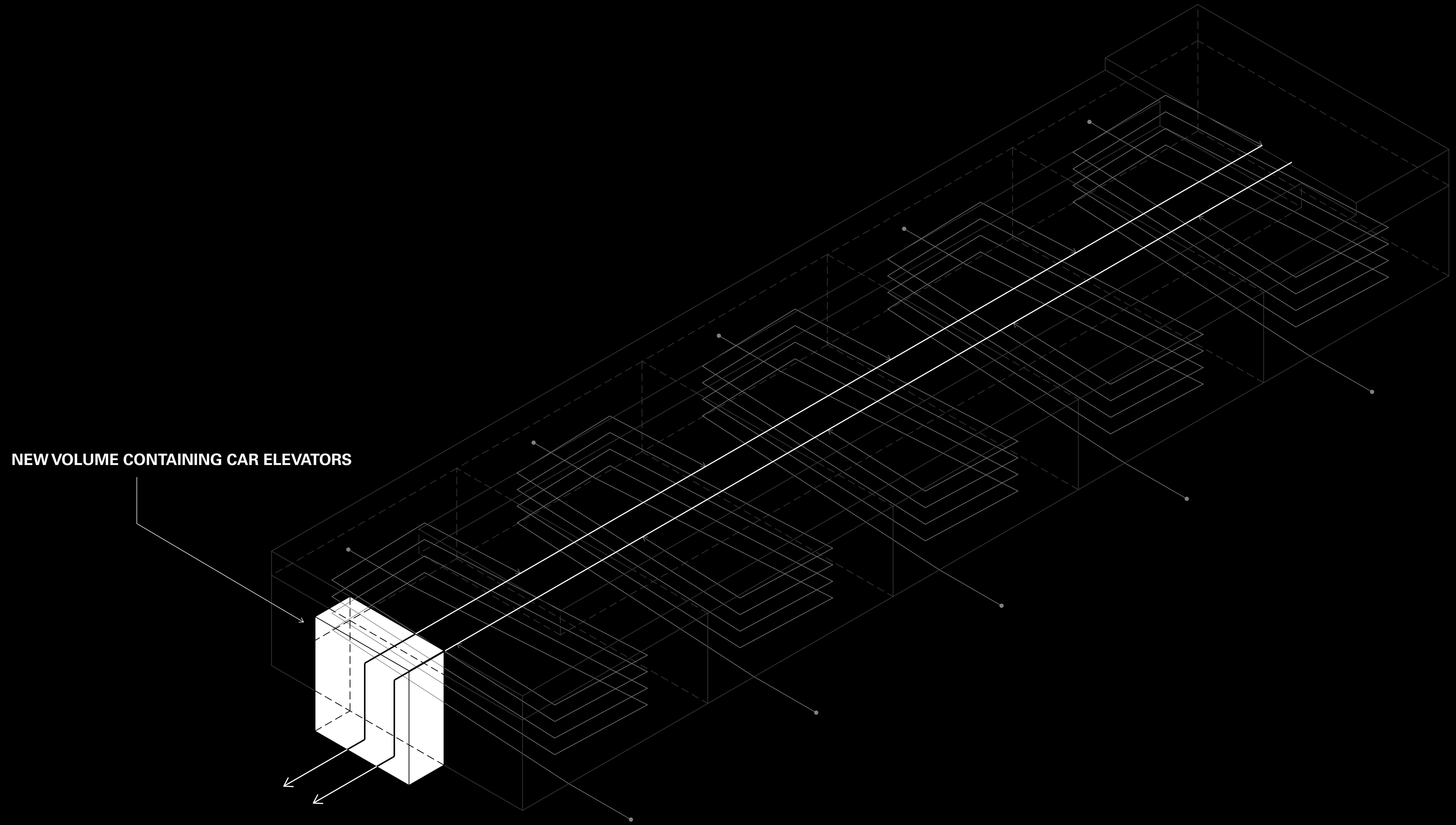




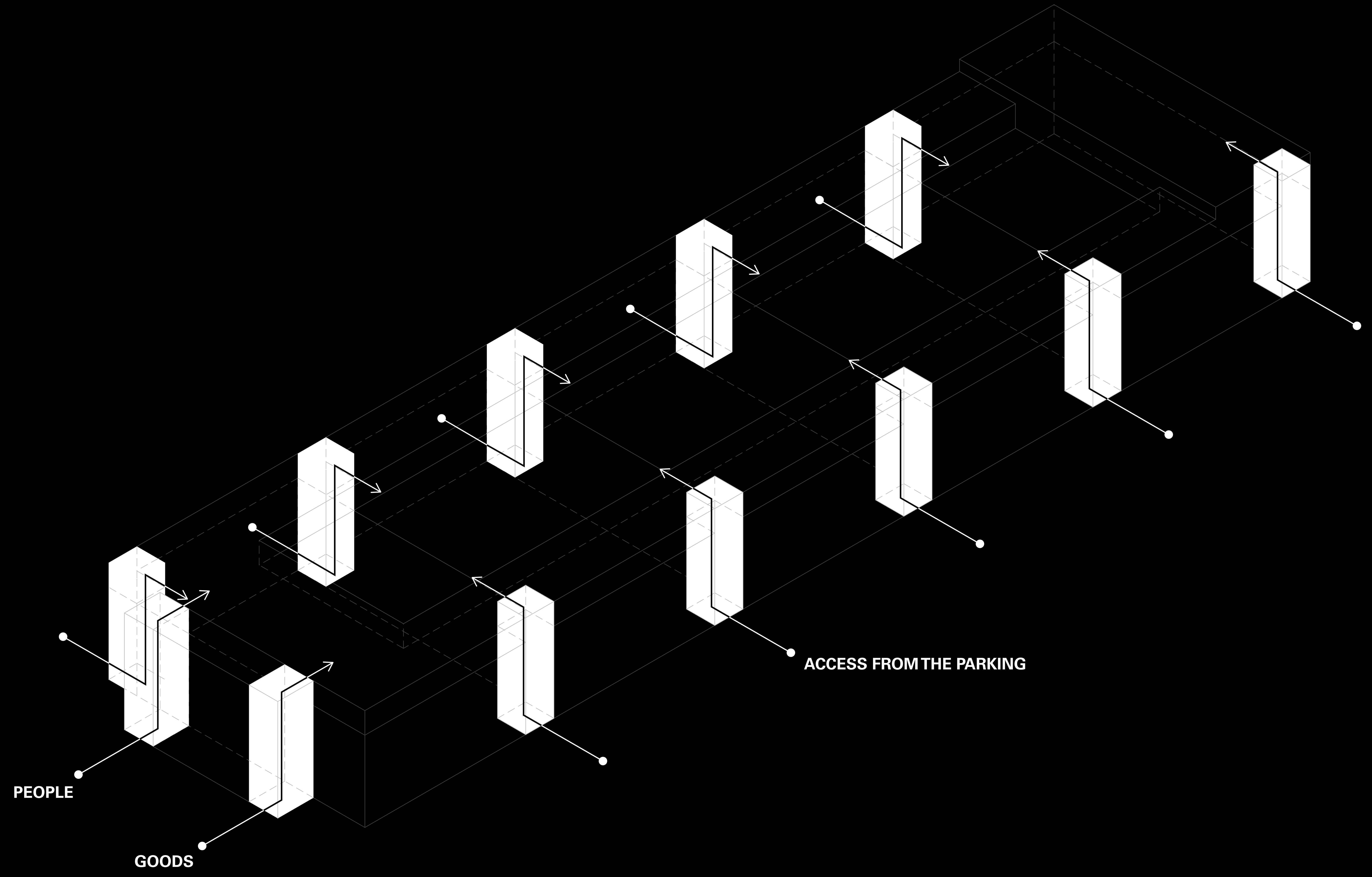
CURRENT EXITS



NEW ENTRANCES



NEW EXITS



DEDICATED ACCESSES TO THE SCHOOL

UNDERGROUND LEVEL


GROUND LEVEL

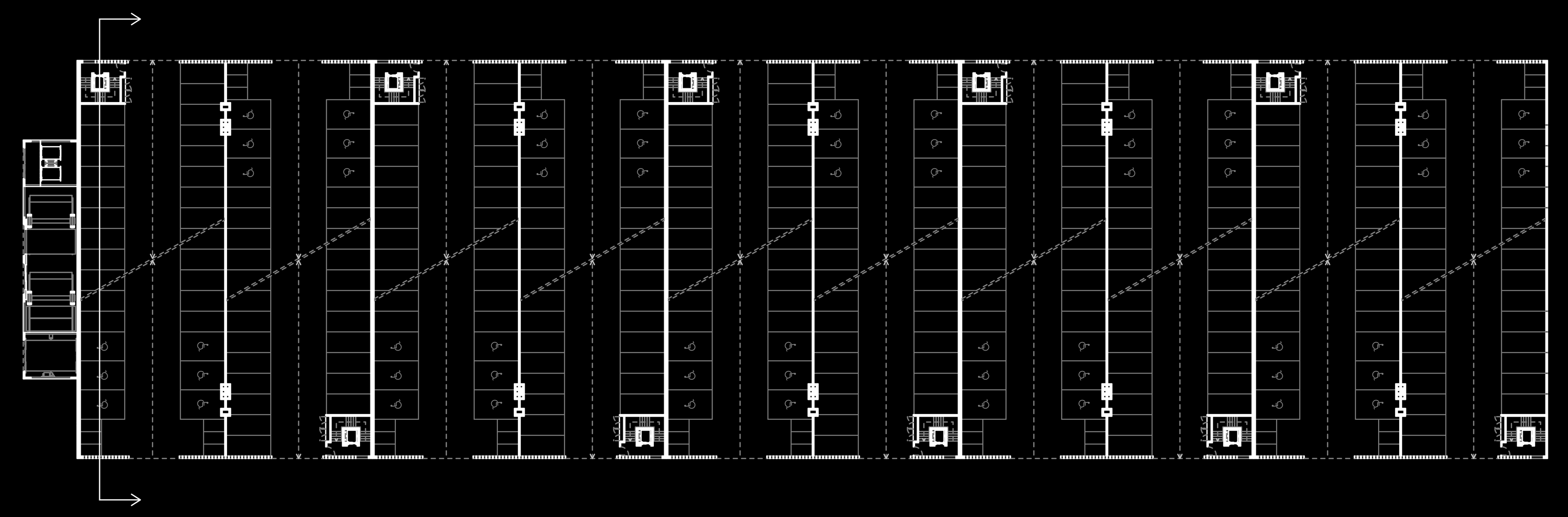

FIRST TO THIRD LEVEL


FORTH LEVEL


SCHOOL

WEST ELEVATION

WEST SECTION



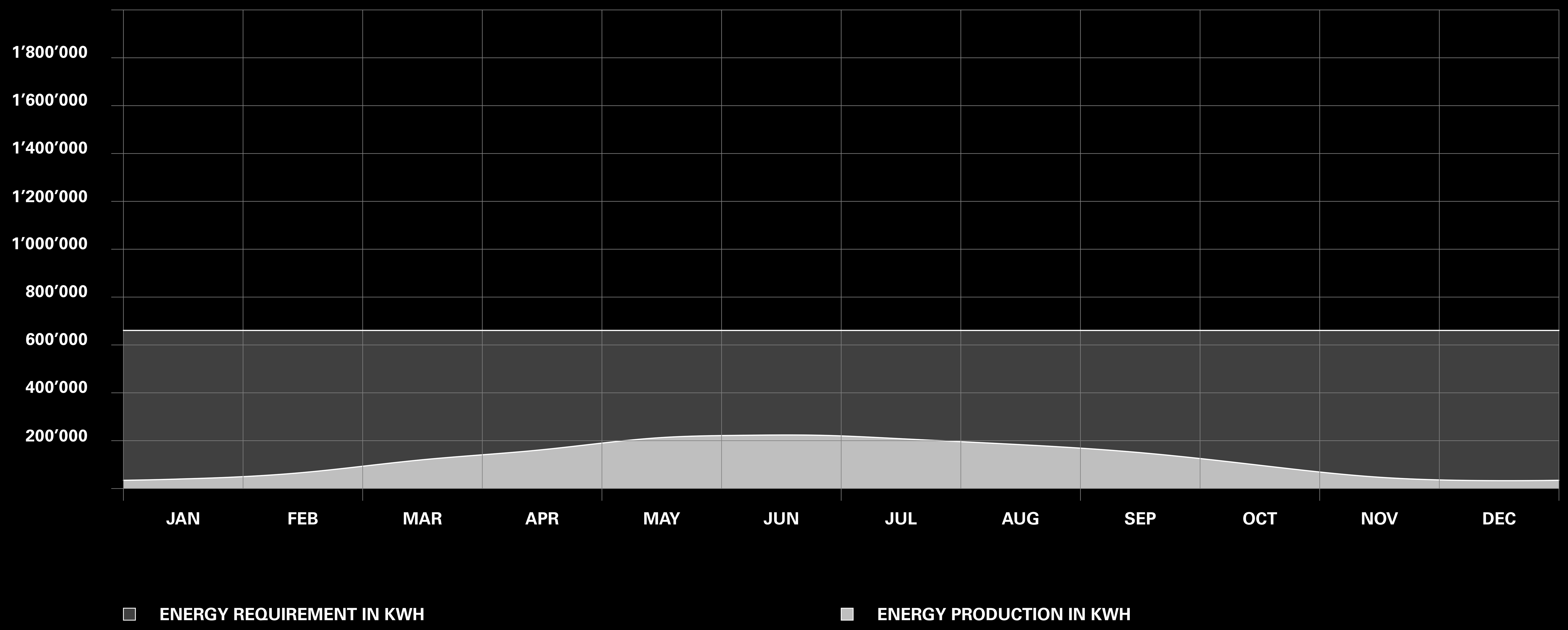
WEST SECTION

III

ENERGY

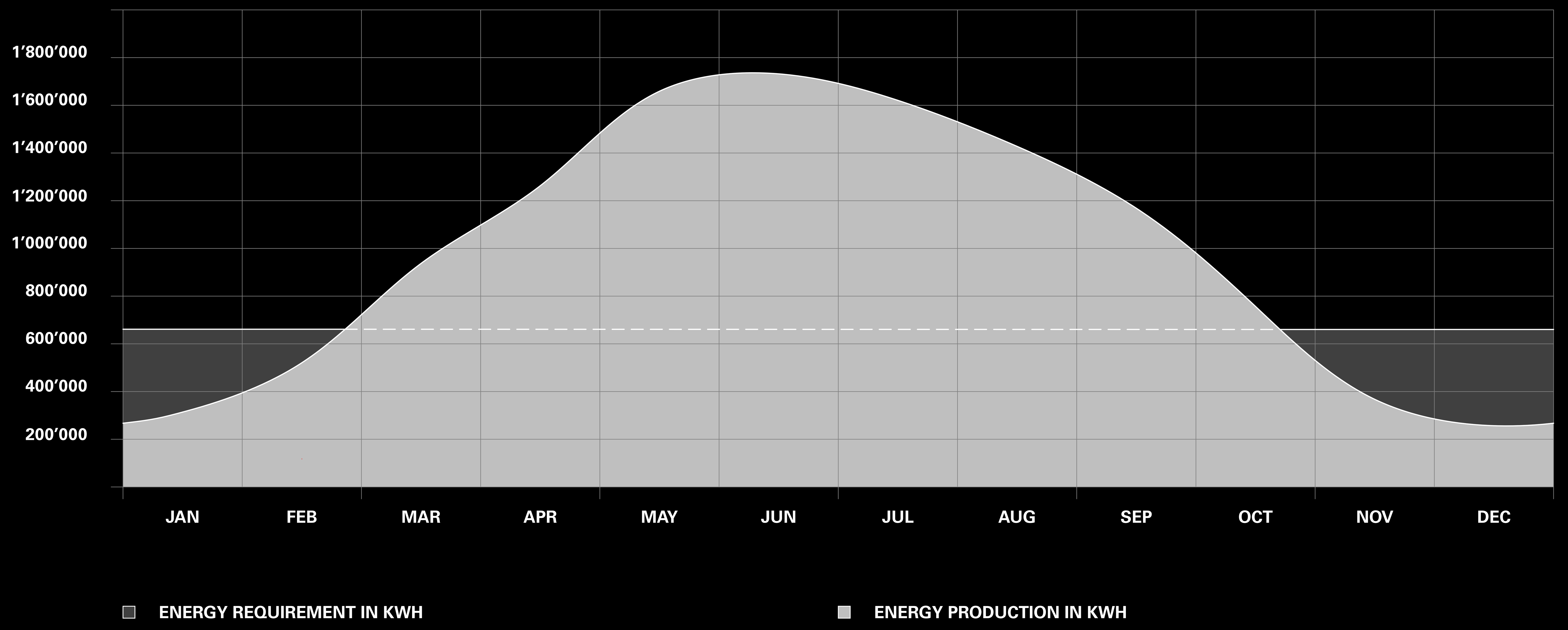
In the interest of sustainable energy development, it is necessary to consider the way in which the electricity necessary to charge the parked vehicles will be produced. Photovoltaic technology offers a good energy conversion index and, in the case of commuters, the pace of production and consumption match. Although the car park coverage already provides an excellent production index, its surface is not sufficient. The Horburg park, situated in front, may provide the missing surface.


5'040 MQ
PHOTOVOLTAIC POTENTIAL



PHOTOVOLTAIC POTENTIAL


37’800 MQ
PHOTOVOLTAIC POTENTIAL



PHOTOVOLTAIC POTENTIAL

a

STRUCTURE

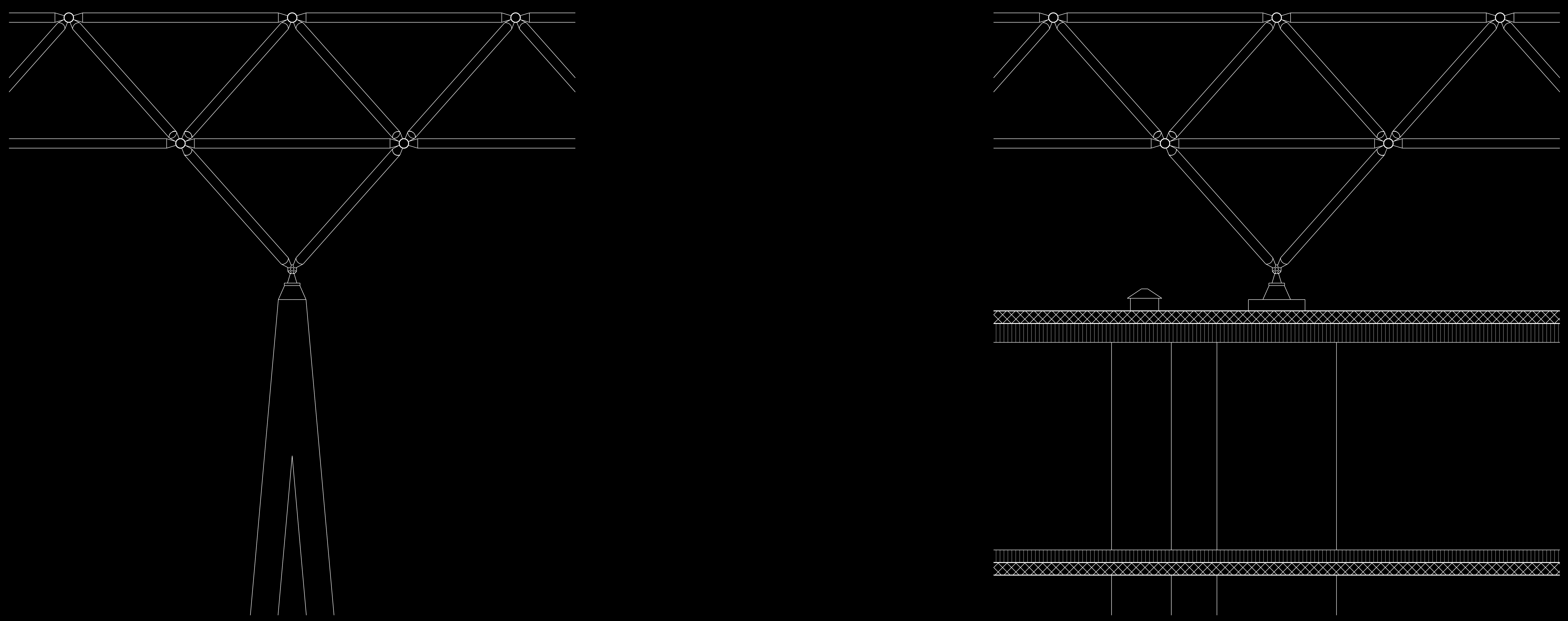
With the intention of producing a strong but respectful architectural gesture, it is proposed to build a continuous photovoltaic roof over the park and the parking lot, located at a height that covers the existing building and does not cause nuisance to the tree and the recreational activities of the park.

The space frame structure, chosen for its construction simplicity and structural performance, adapts its span to that of the car park, producing a tectonic link between the two. Emphasis is placed on the meeting points between the vertical supports and the horizontal structure, which convey an impression of lightness.

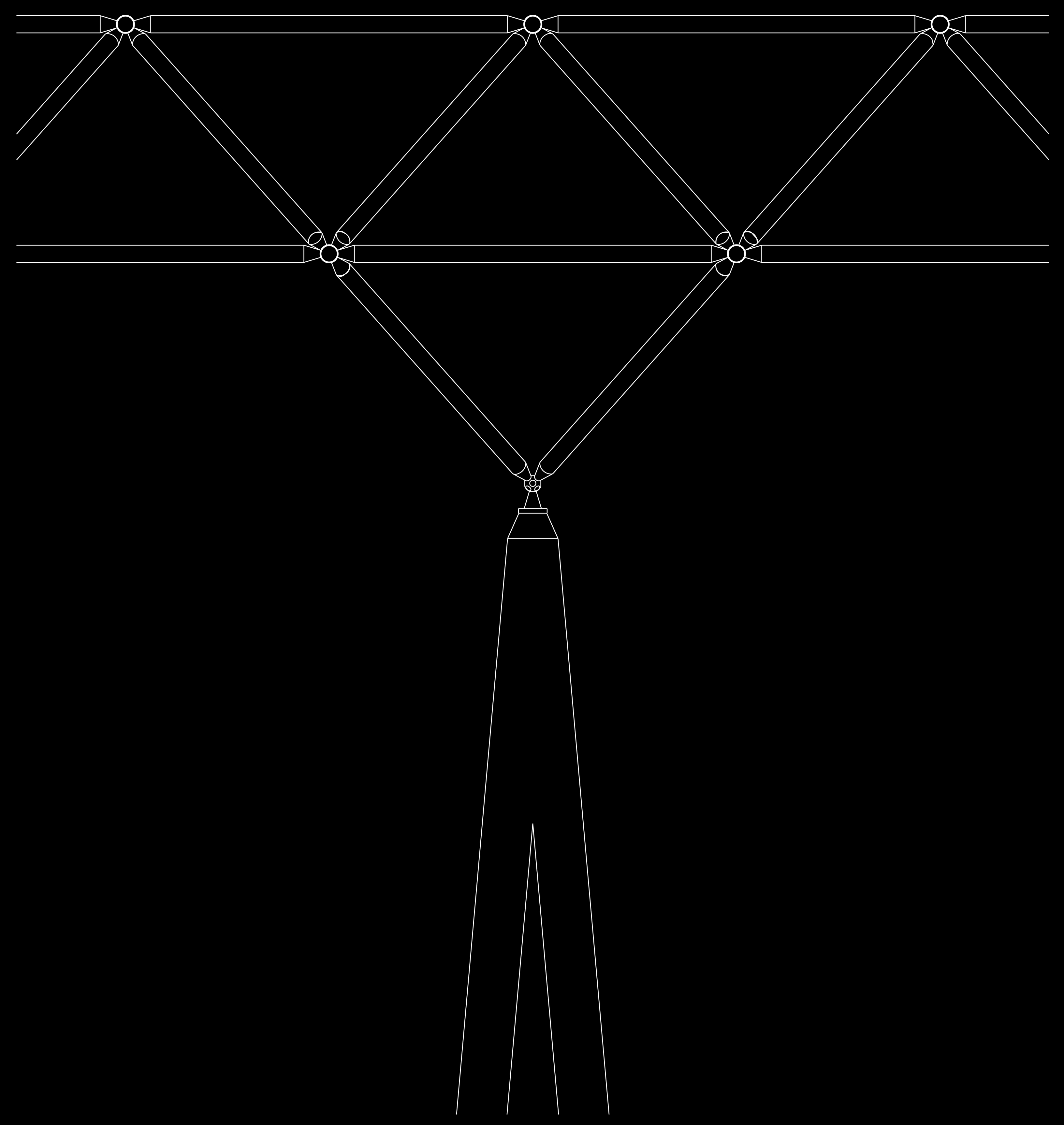
MINIMUM CANOPY HEIGHT

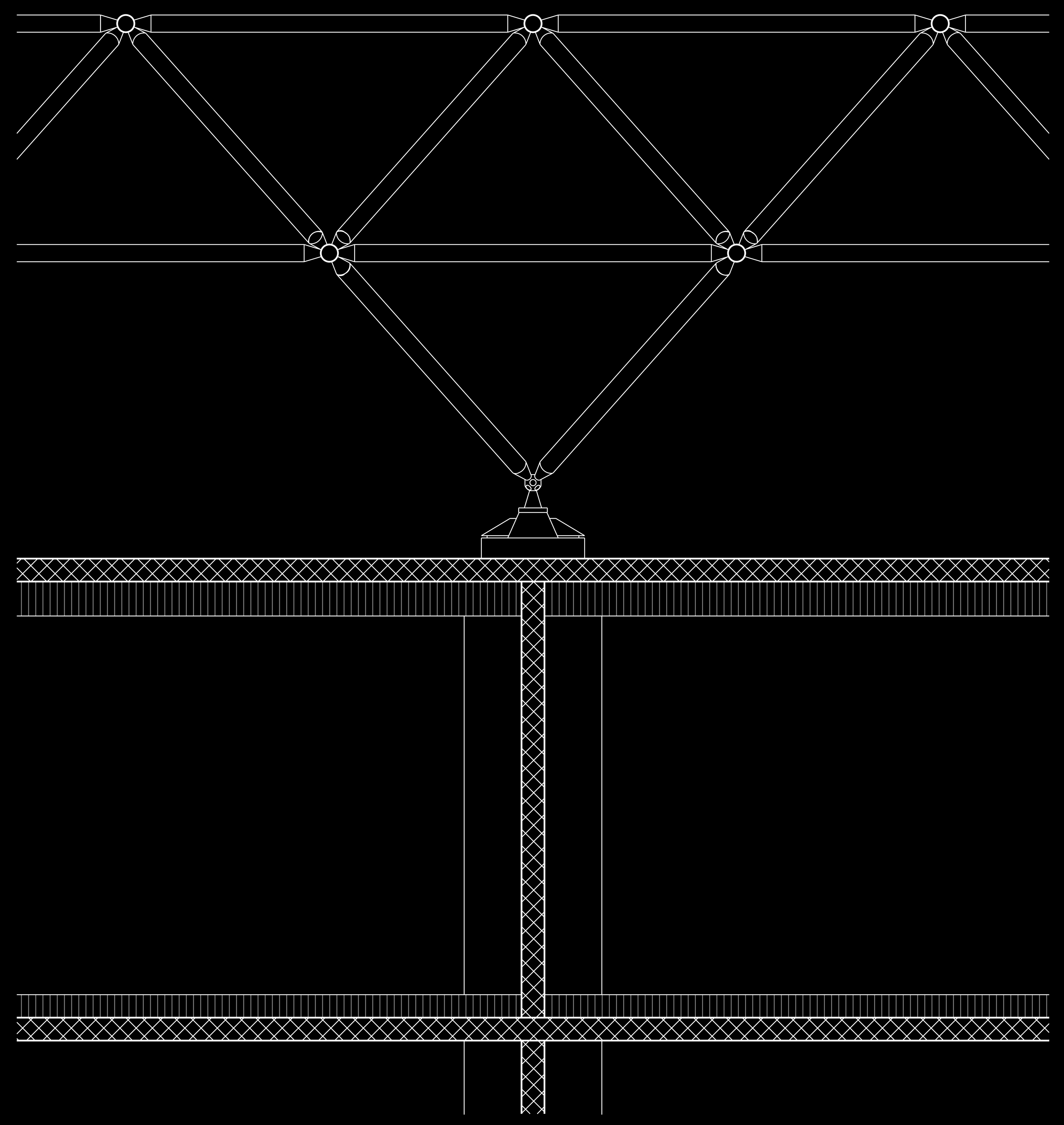

35.5 METERS
32 METERS
HORIZONTAL SPAN

WEST ELEVATION



WEST VIEW





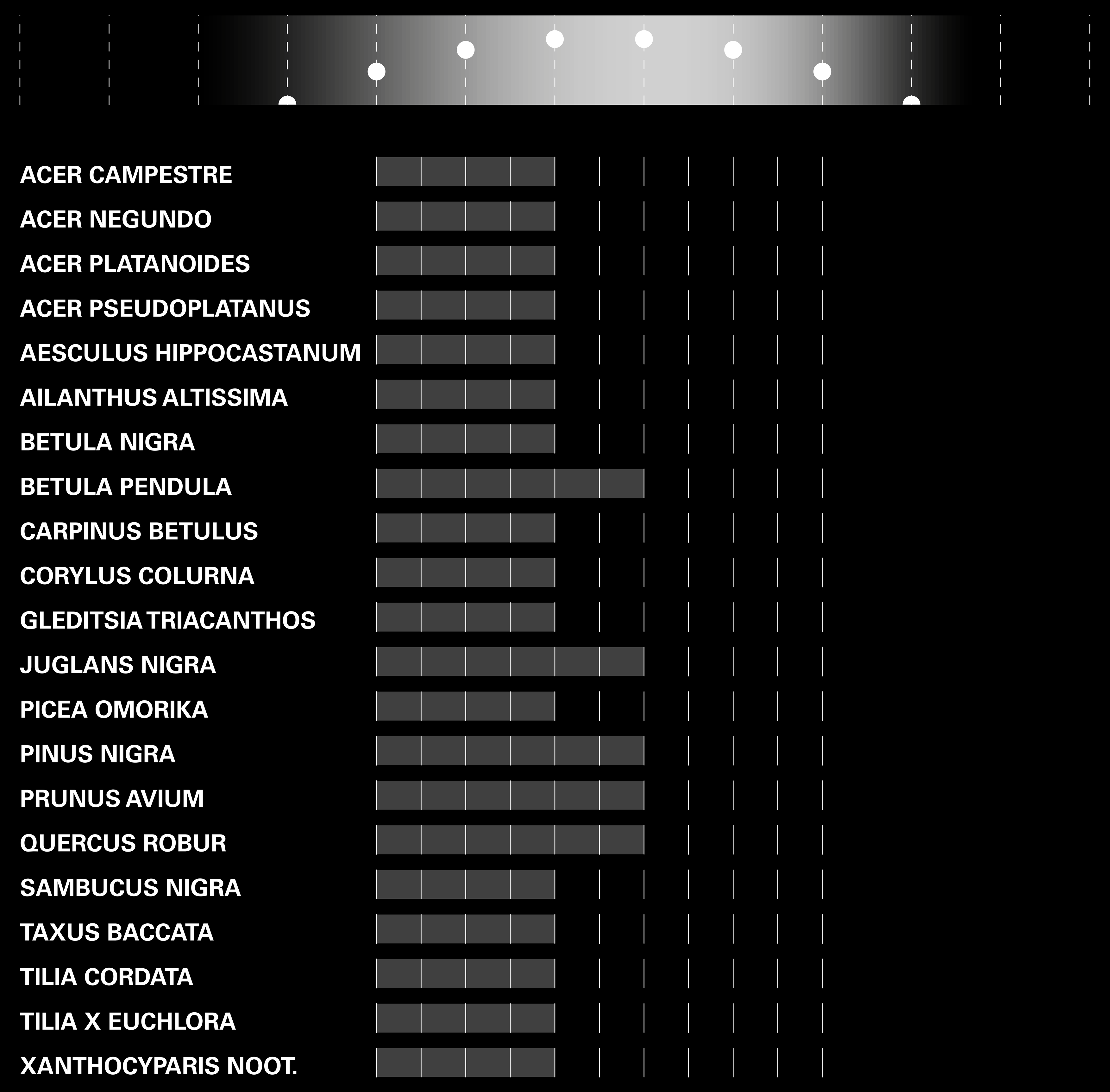
SOUTH VIEW

b

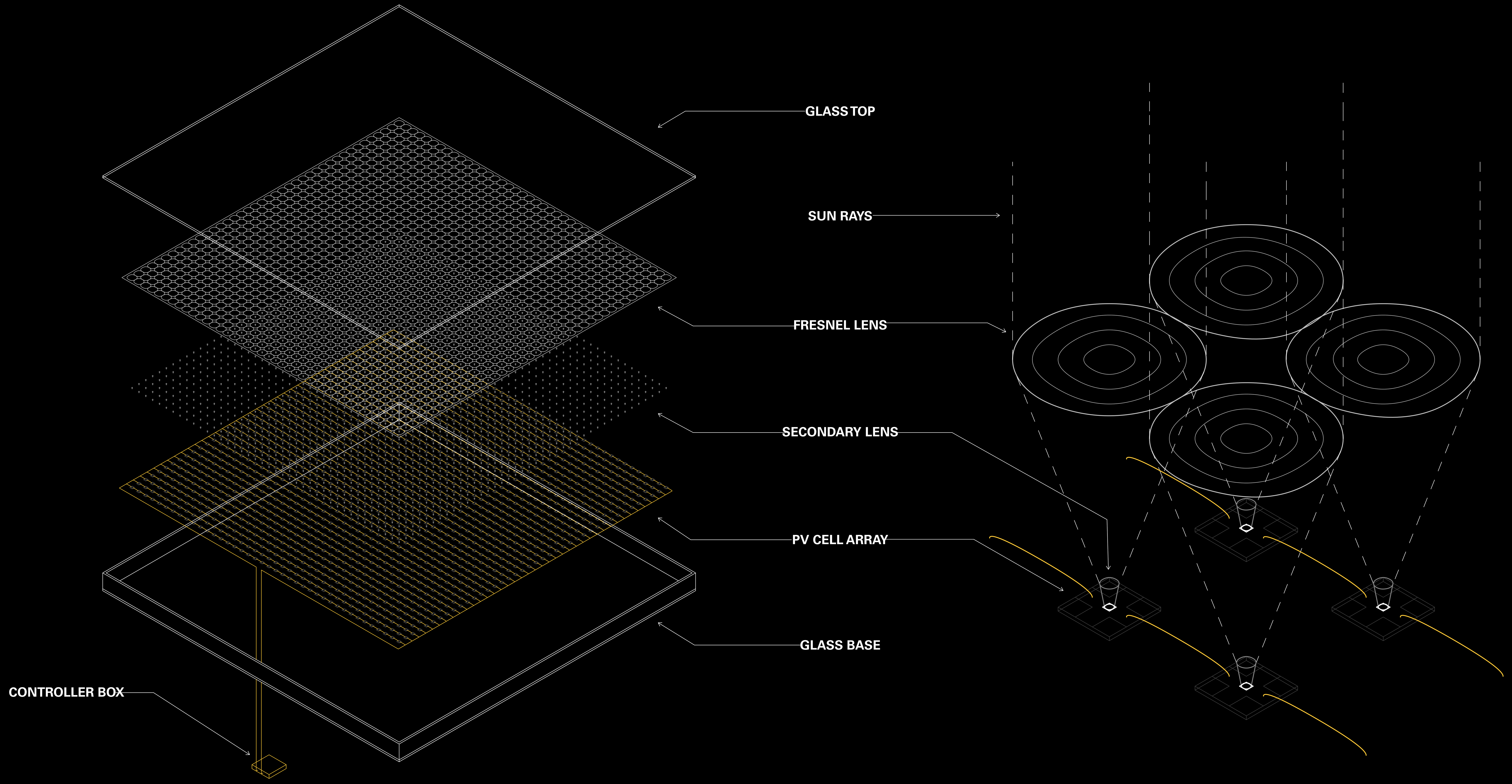
LIGHT AND ELECTRICITY

The roofing consists of concentrated photovoltaic panels, which use lenses to focus sunlight on tiny but efficient solar cells. Alignment with the sun is ensured through the horizontal movement of the lens array. The coverage also ensures that the physiological needs of the plants are respected. For a few hours of the day, the panels decrease their energy performance to redirect the light onto the vegetation below.

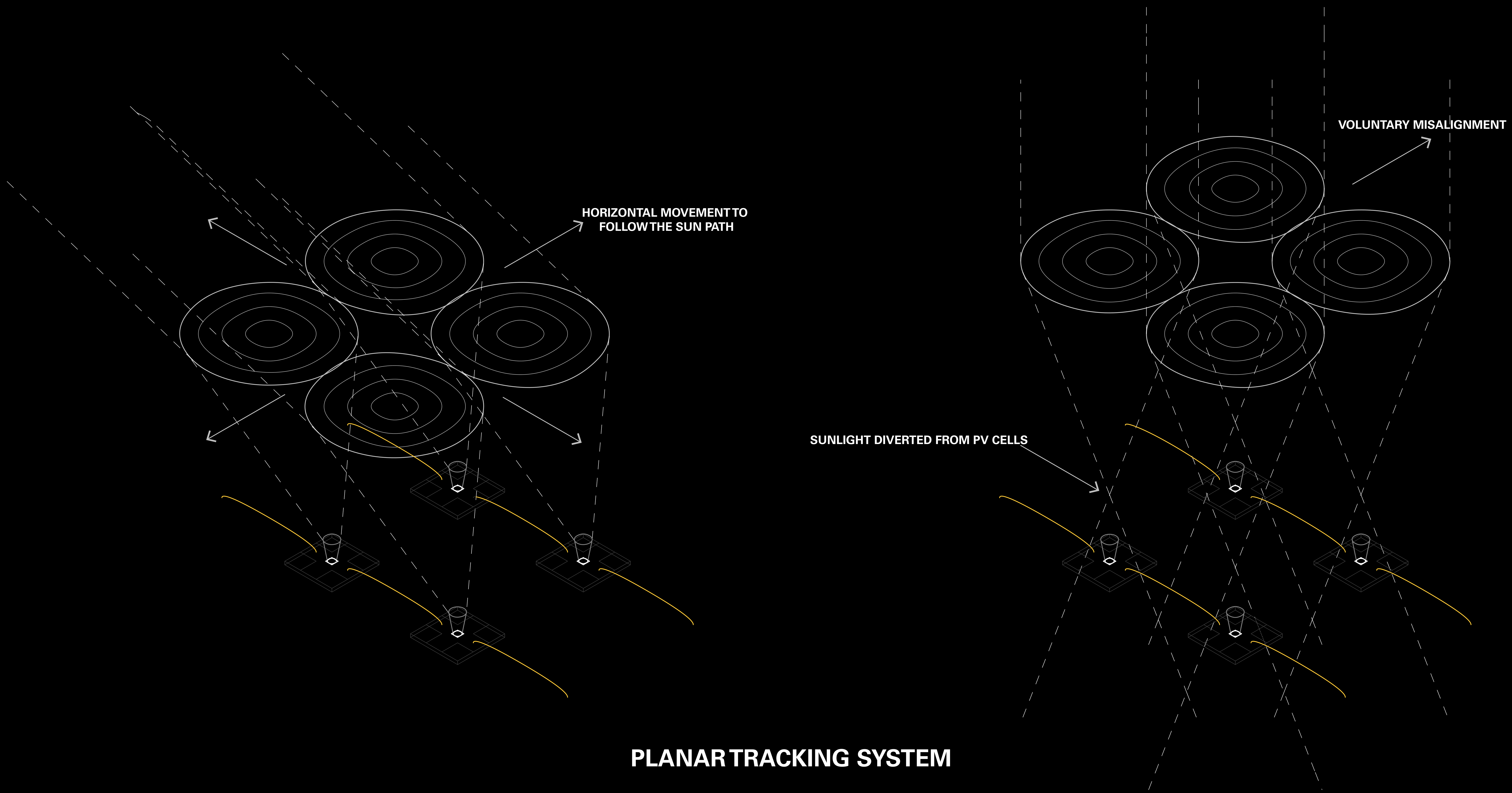
The access at the roof for maintaning and cleaning the panels is done through mobiles platforms that slide on rails above the panels.



REQUIRED SUNLIGHT HOURS BY TREES



PV PANEL COMPOSITION



PLANAR TRACKING SYSTEM

On clear days, direct sunlight in a concentrated beam illuminates only a fraction of all leaves in the upper canopy, while most of the subcanopy and understorey vegetation are in deep shade. The concentrated energy at the canopy top can cause photosynthetic saturation and reduce canopy light use efficiency [...].

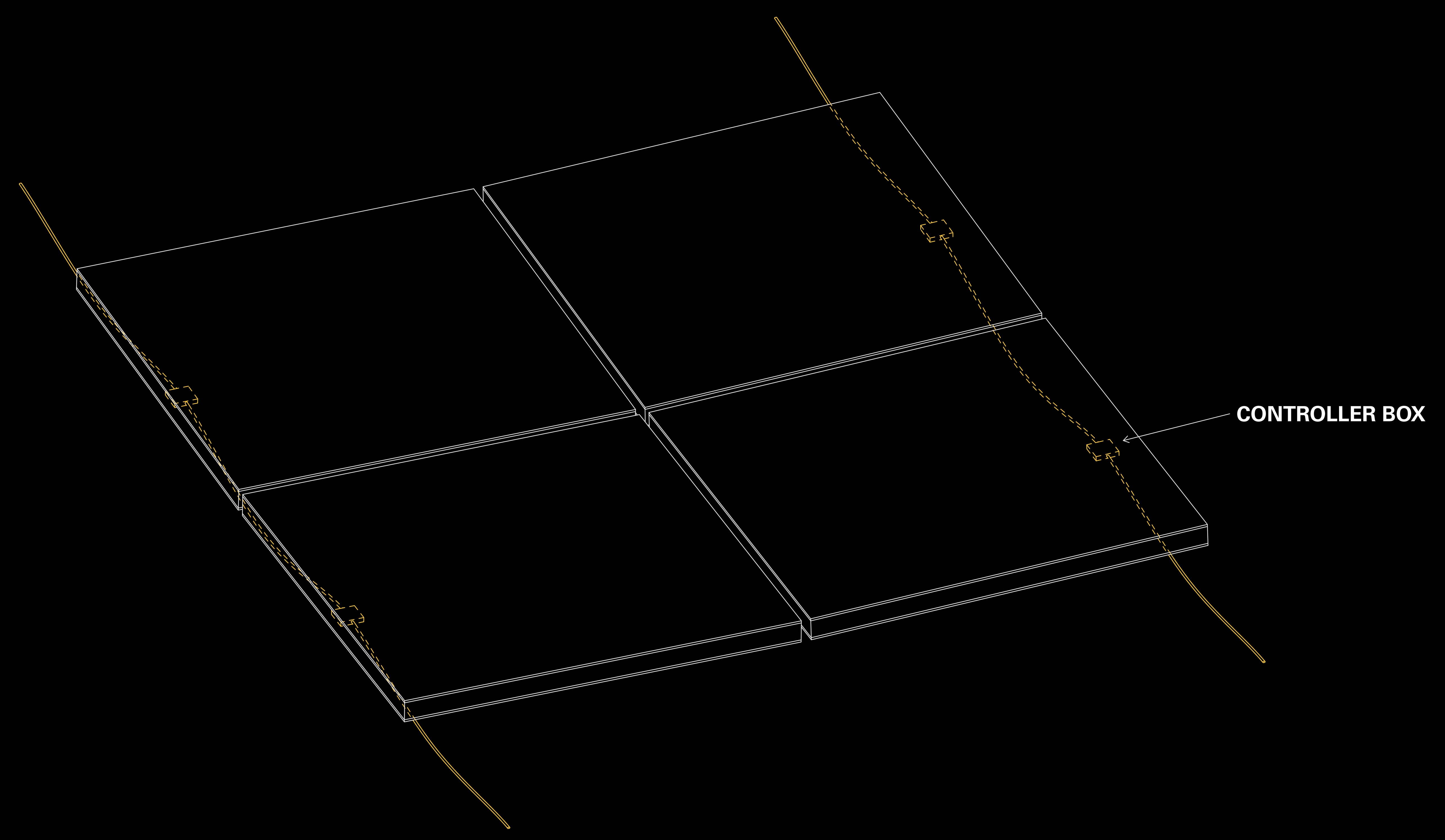
Further increases in light level after saturation can rapidly downregulate gas exchange via stomatal limitation due to leaf water stress [...] and eventually the leaf cannot keep up with evaporative demand. This results in leaf heating and suboptimal (high) leaf temperatures that cause a decline in water use efficiency [...] and photosynthesis but an increase in photorespiration.

However, in the presence of diffuse radiation, the normally shaded subcanopy vegetation can be illuminated more evenly as radiation comes from all directions of the sky, is reflected within the canopy and can penetrate deeper into the canopy.

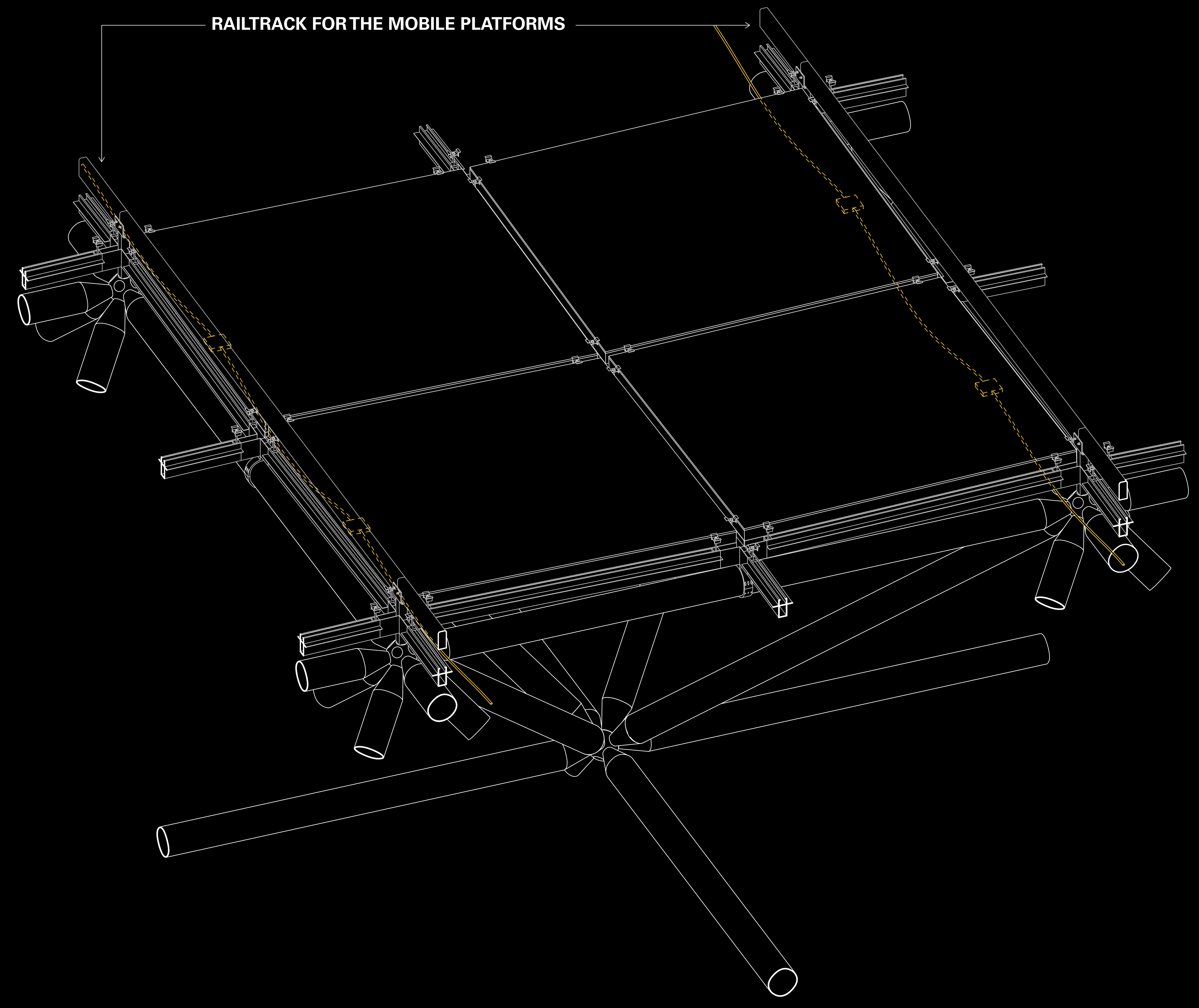
The even distribution of radiation within a plant canopy is important because photosynthesis is greater if two leaves receive moderate light than if one leaf receives bright light while the other is in deep shade. For shaded leaves, even a small increase in radiation can enhance canopy photosynthesis because they are generally light limited and therefore responds quickly to higher radiation.

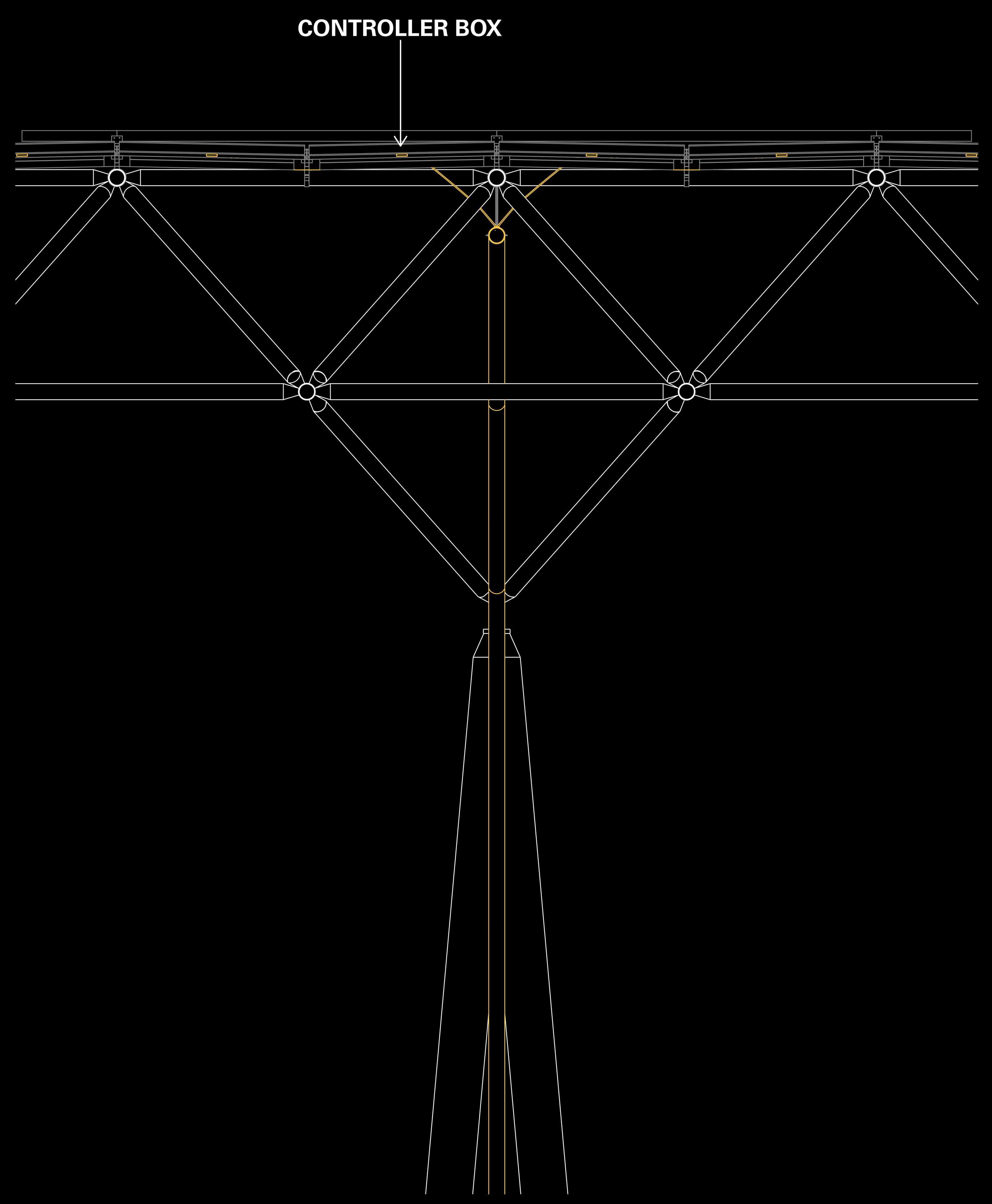
Overall, diffuse radiation of moderate intensity may reduce the photosynthetic saturation of the canopy as a whole but increase the canopy [light use efficiency] compared to direct sunlight.

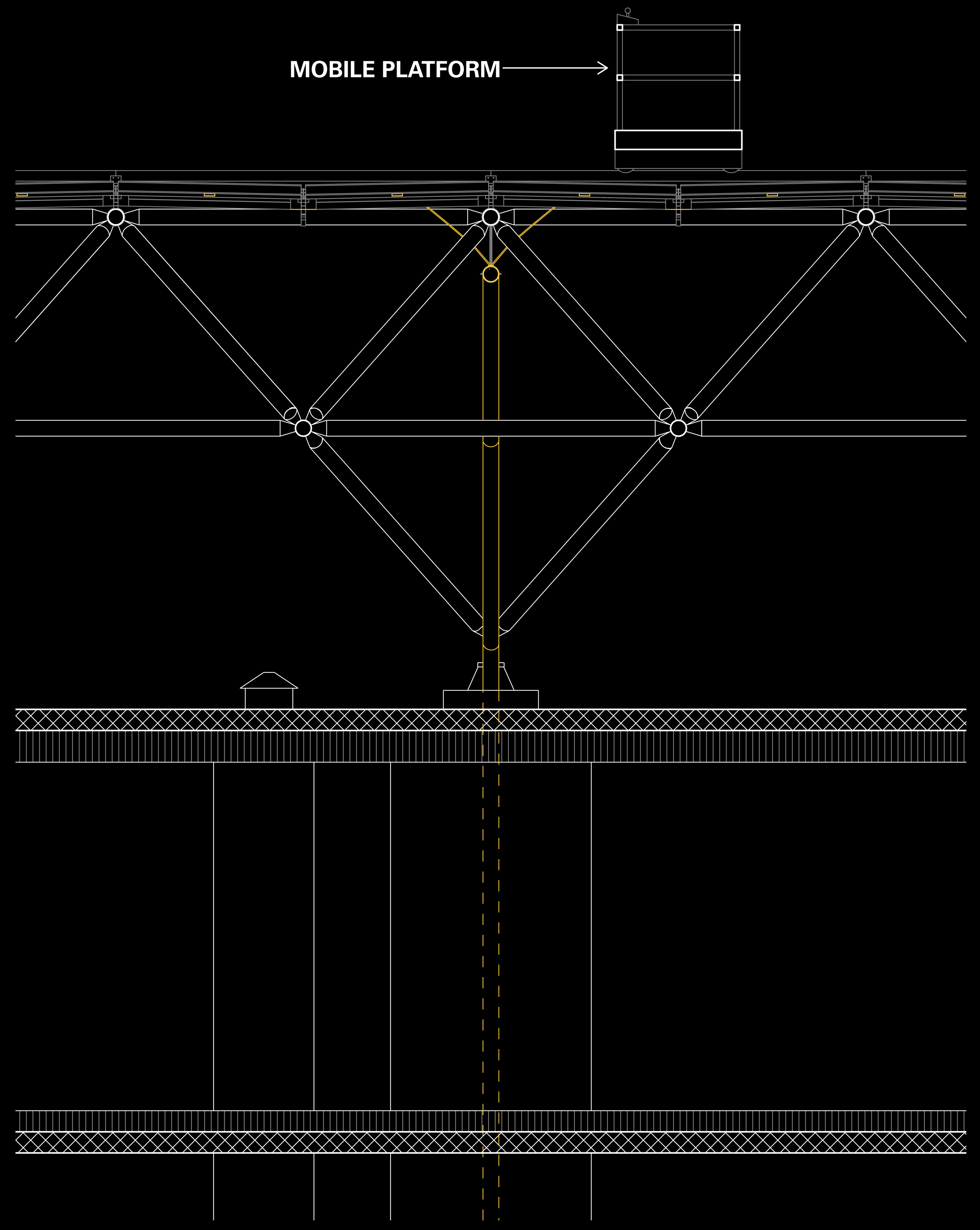
KANNIAH AND AL. , PROGRESS IN PHYSICAL GEOGRAPHY (2012)



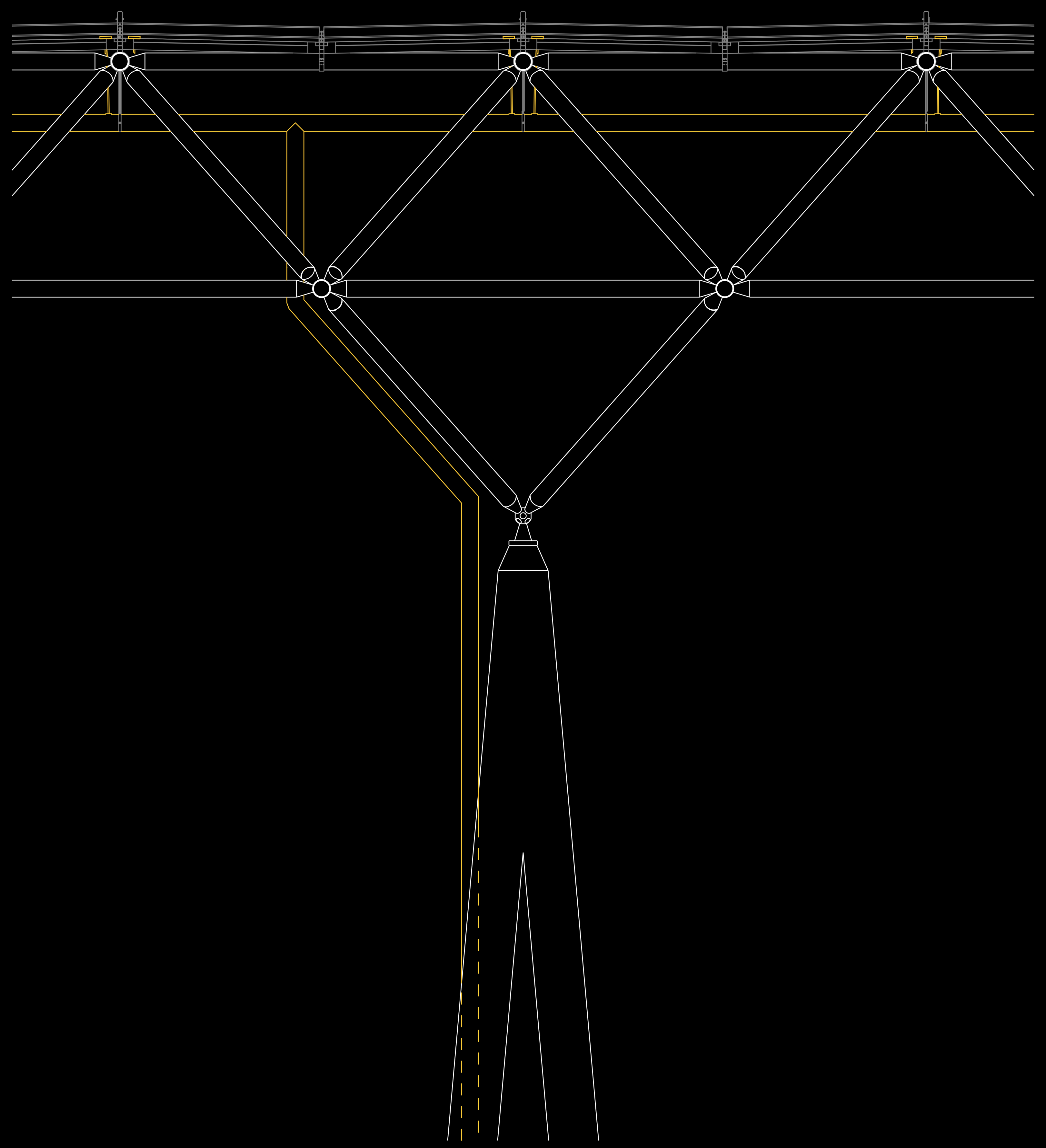
PV PANELS CONNECTED IN SERIES

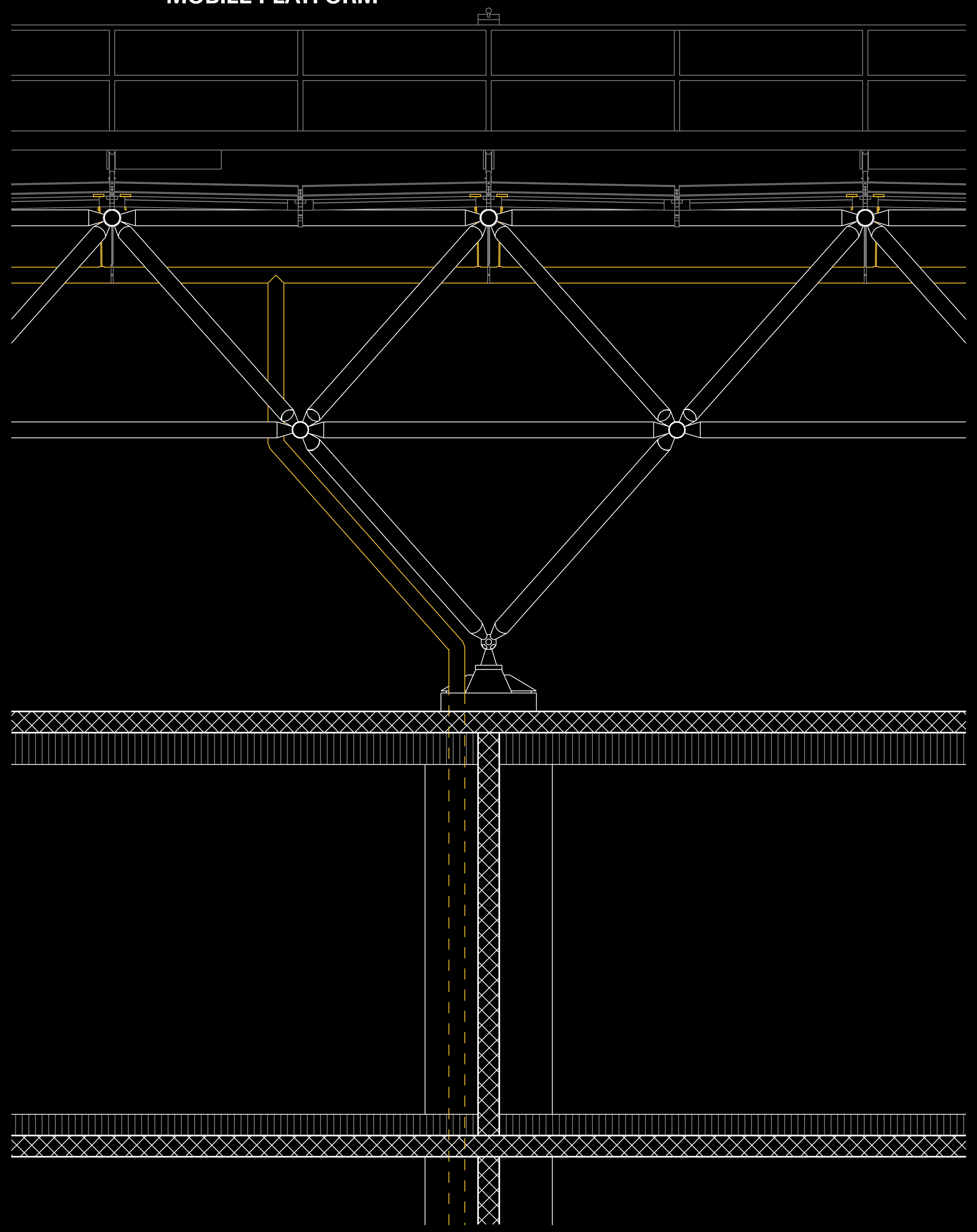

RAILTRACK FOR THE MOBILE PLATFORMS



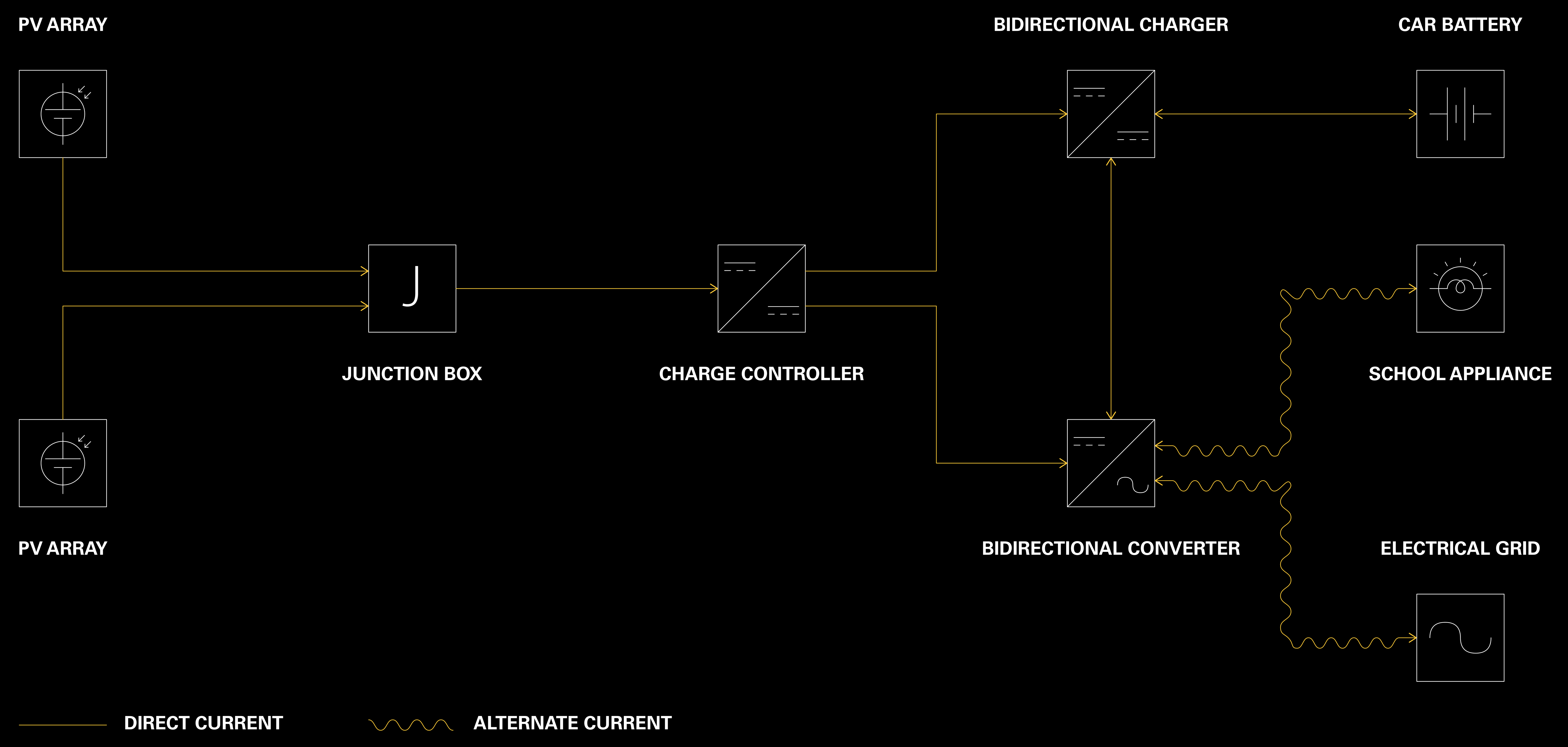


WEST VIEW



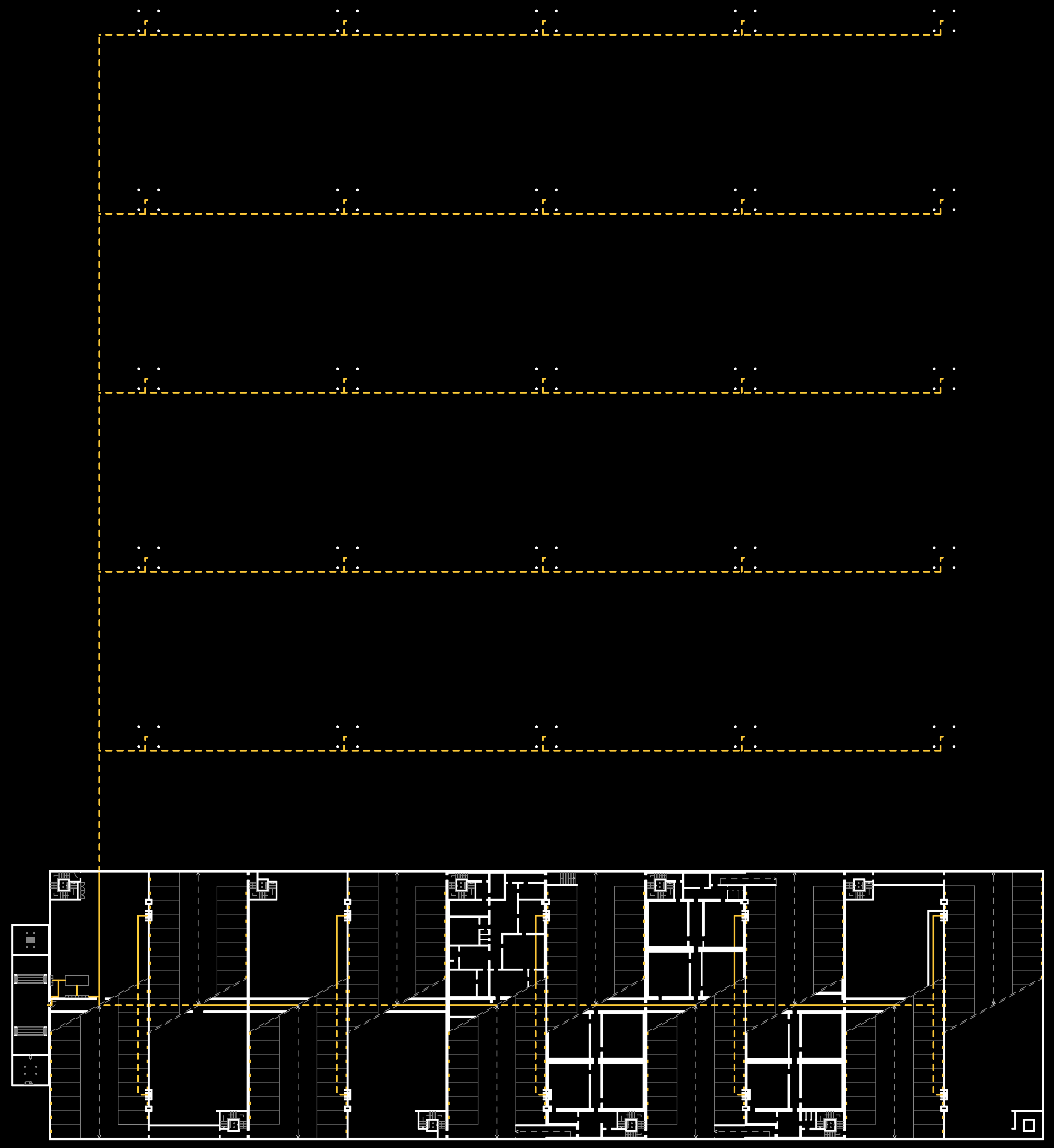


SOUTH VIEW

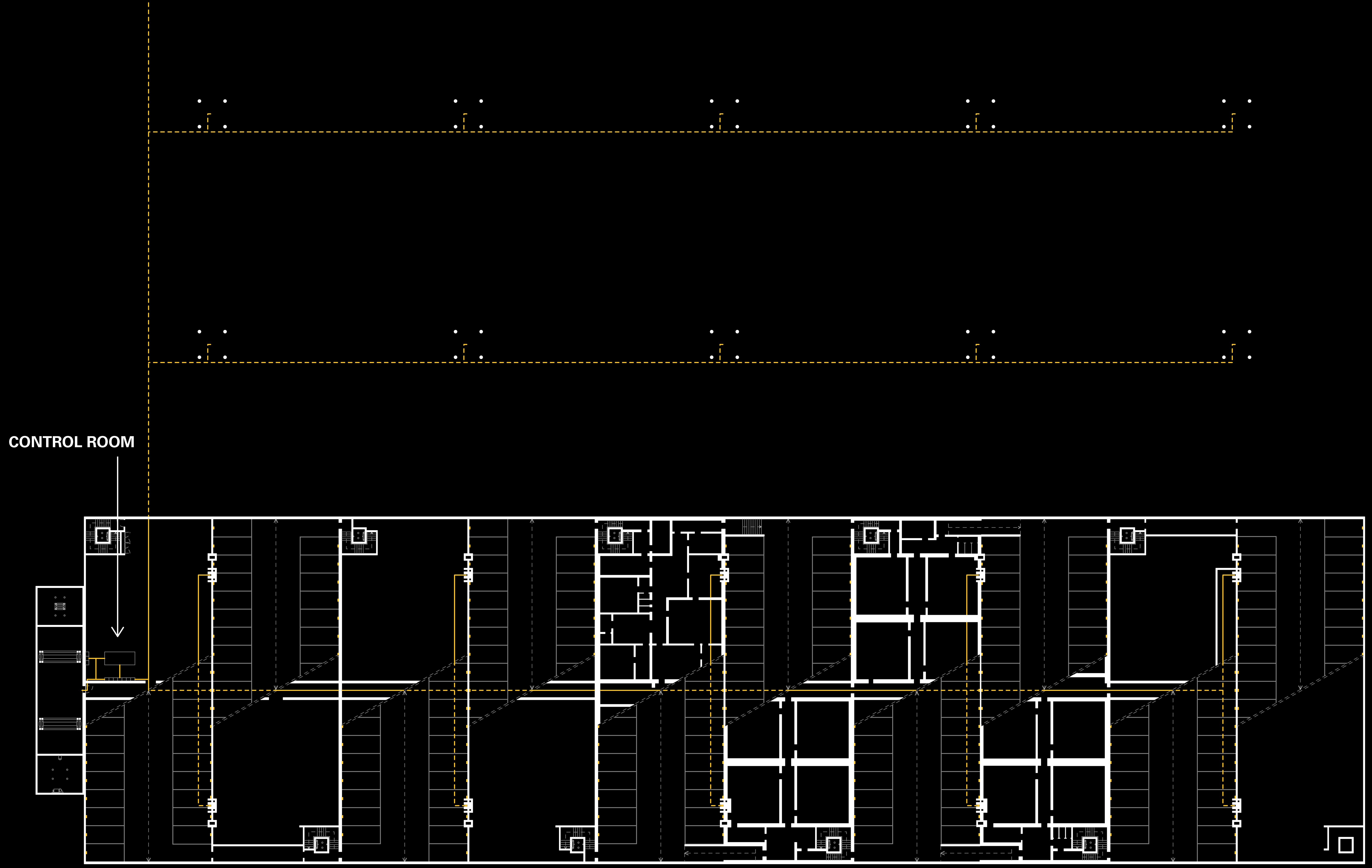


CIRCUIT DIAGRAM

ELECTRICAL ROUTE



ELECTRICAL ROUTE

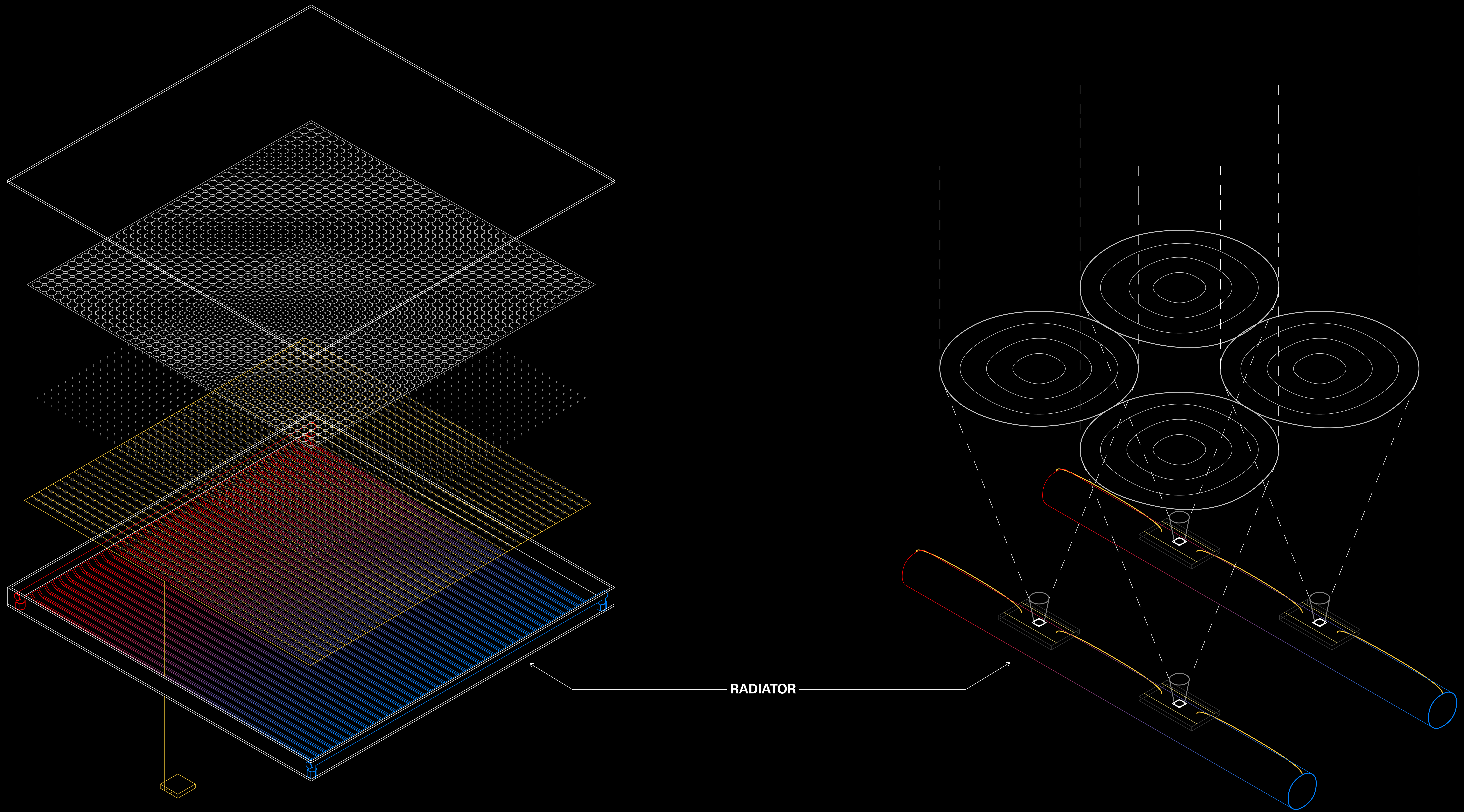


ELECTRICAL ROUTE

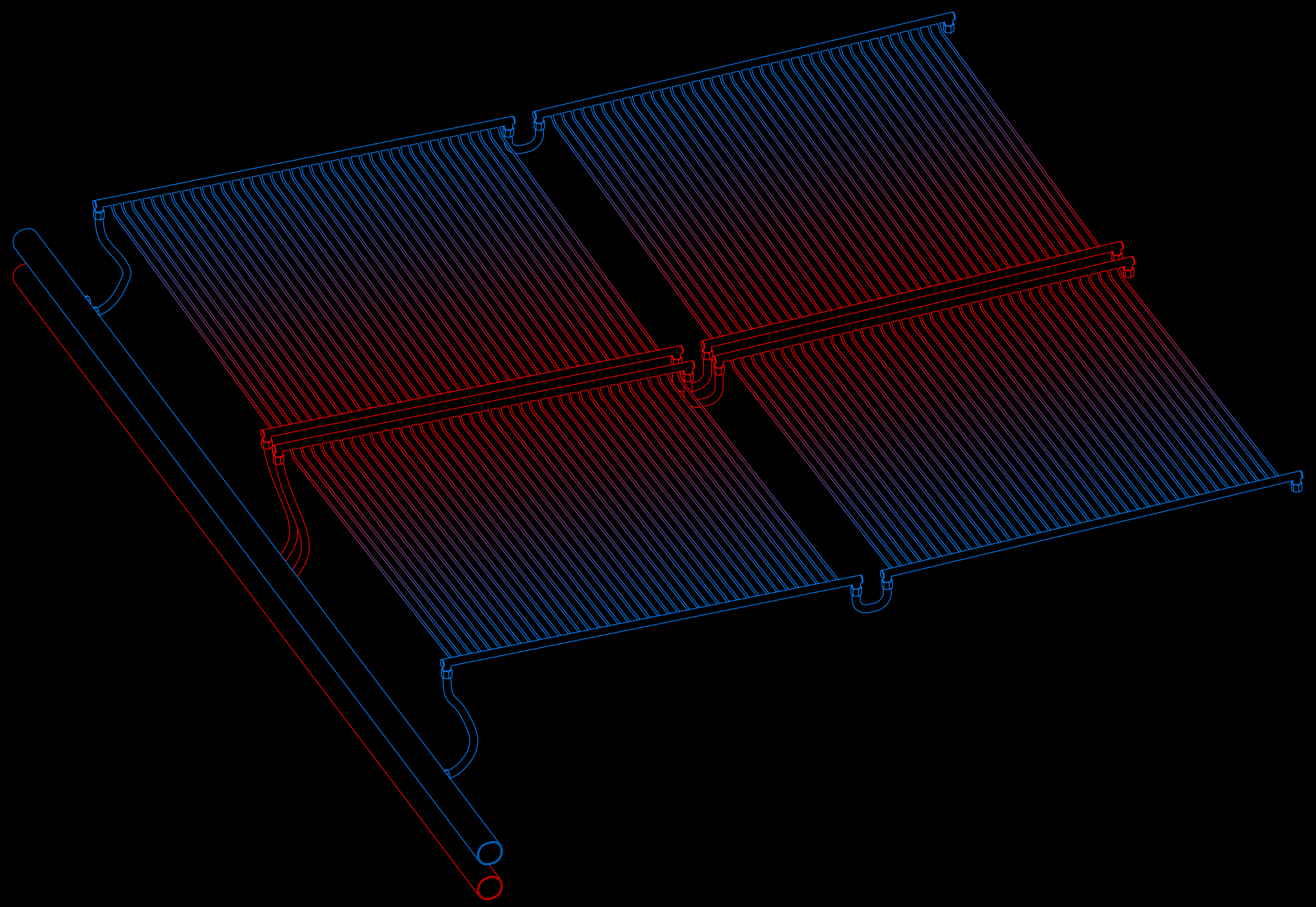
C

HEATING AND COOLING

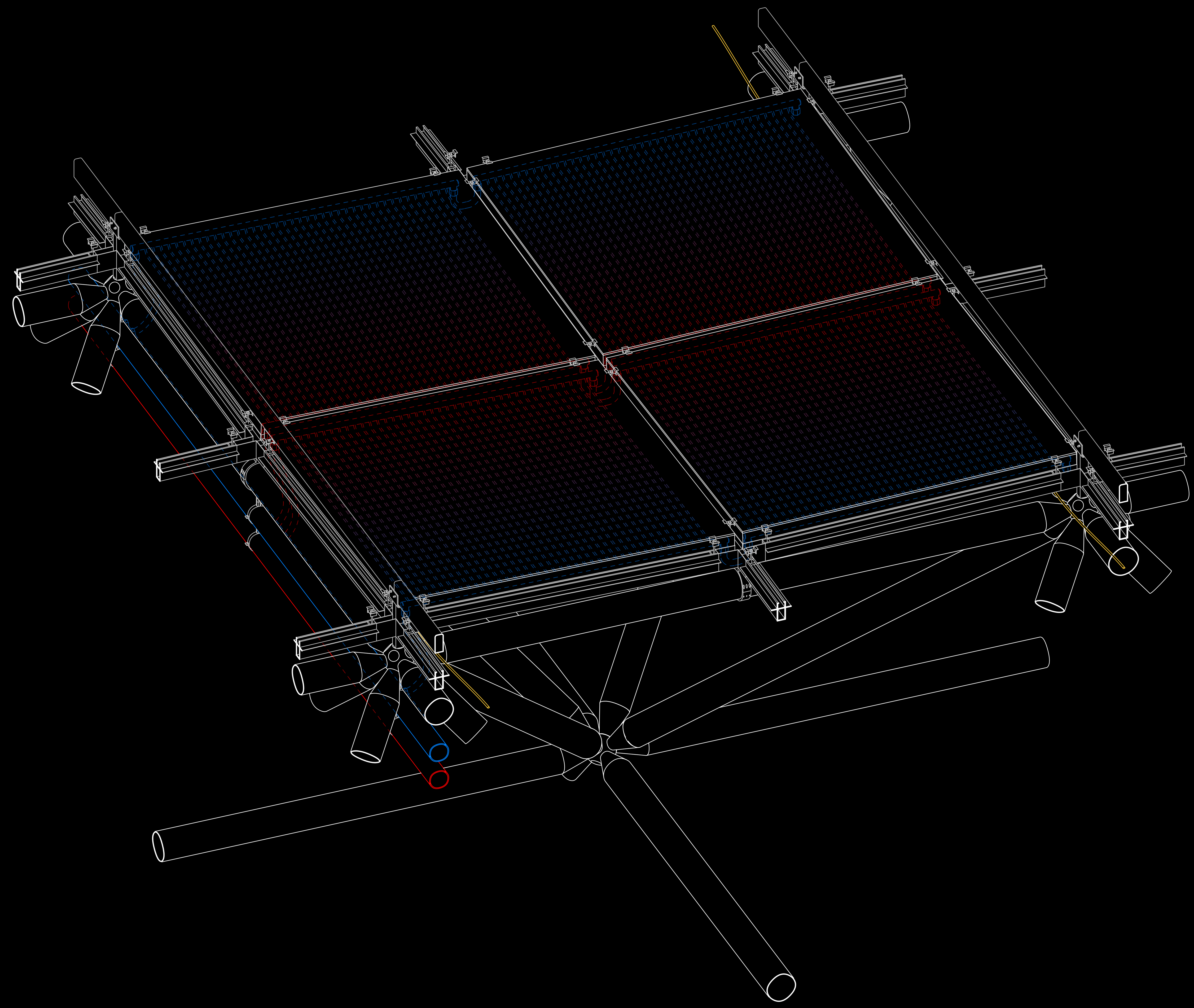
The heat produced by the cells, which leads to a decrease in efficiency, is extracted from the panel and stored under the parking lot, to be used for heating the school and the surrounding homes.
A borehole seasonal storage system ensure that the thermal energy needs of the project and of part of the surrounding buildings are met all year round.

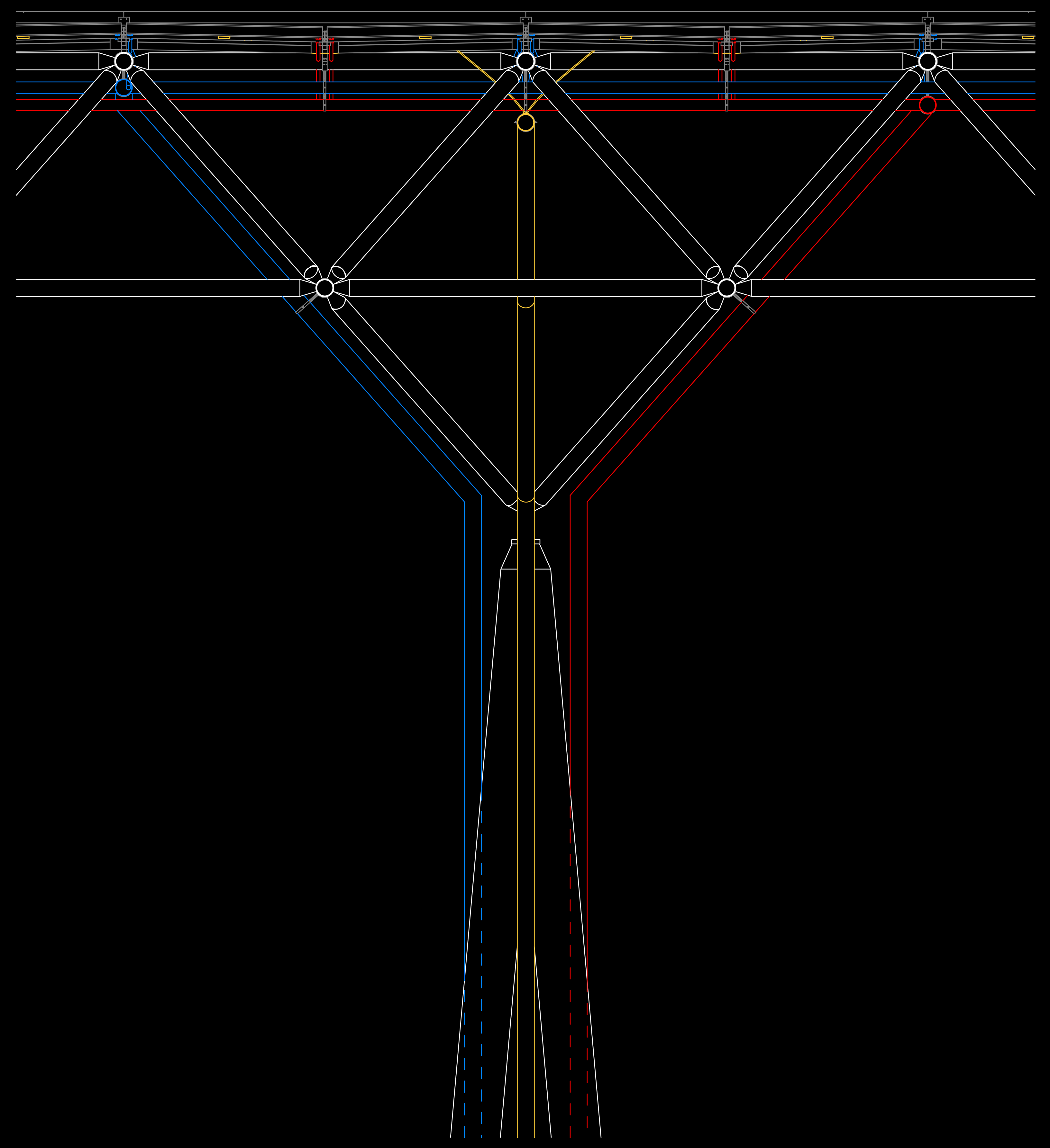


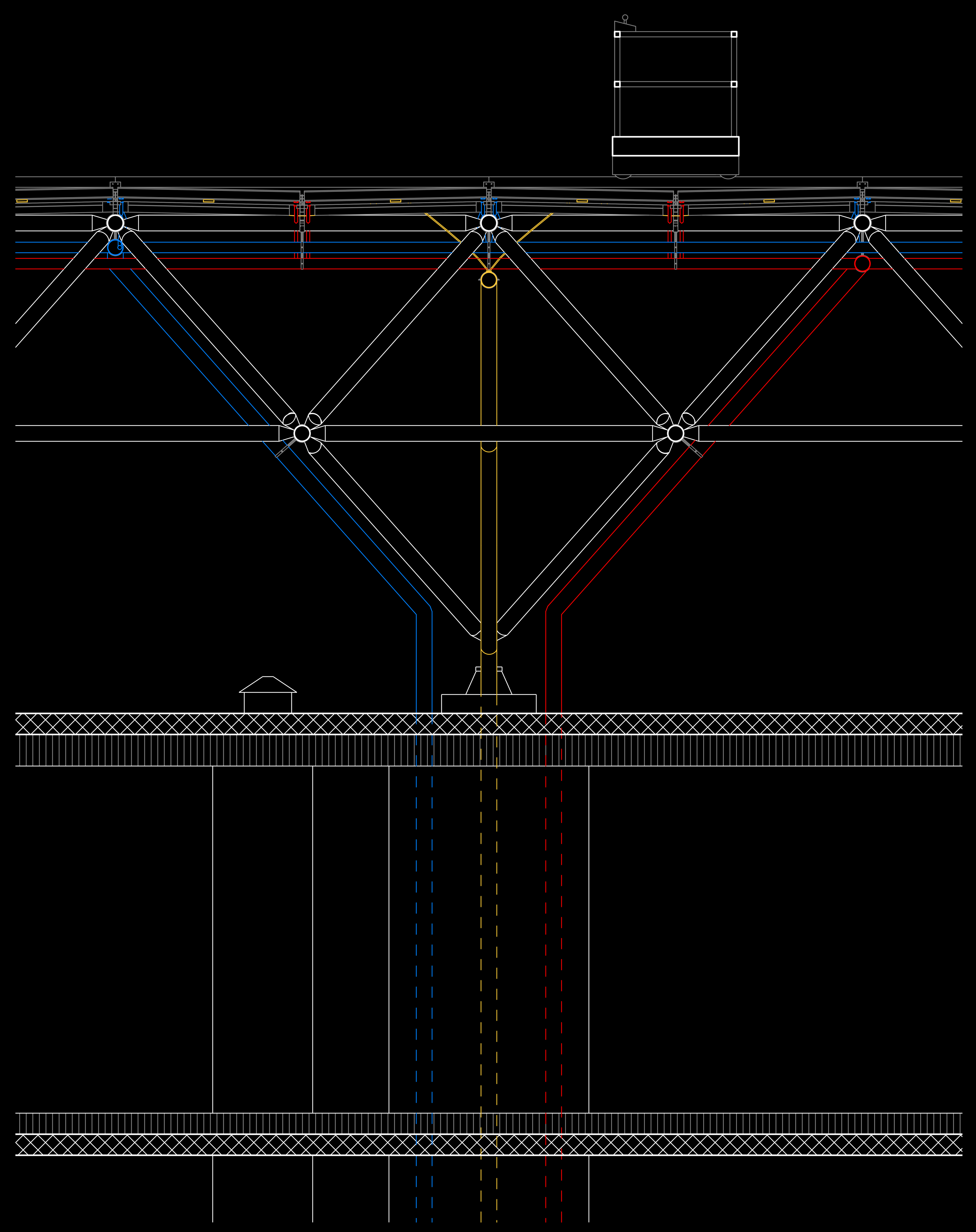
HYBRID PV THERMAL PANEL COMPOSITION



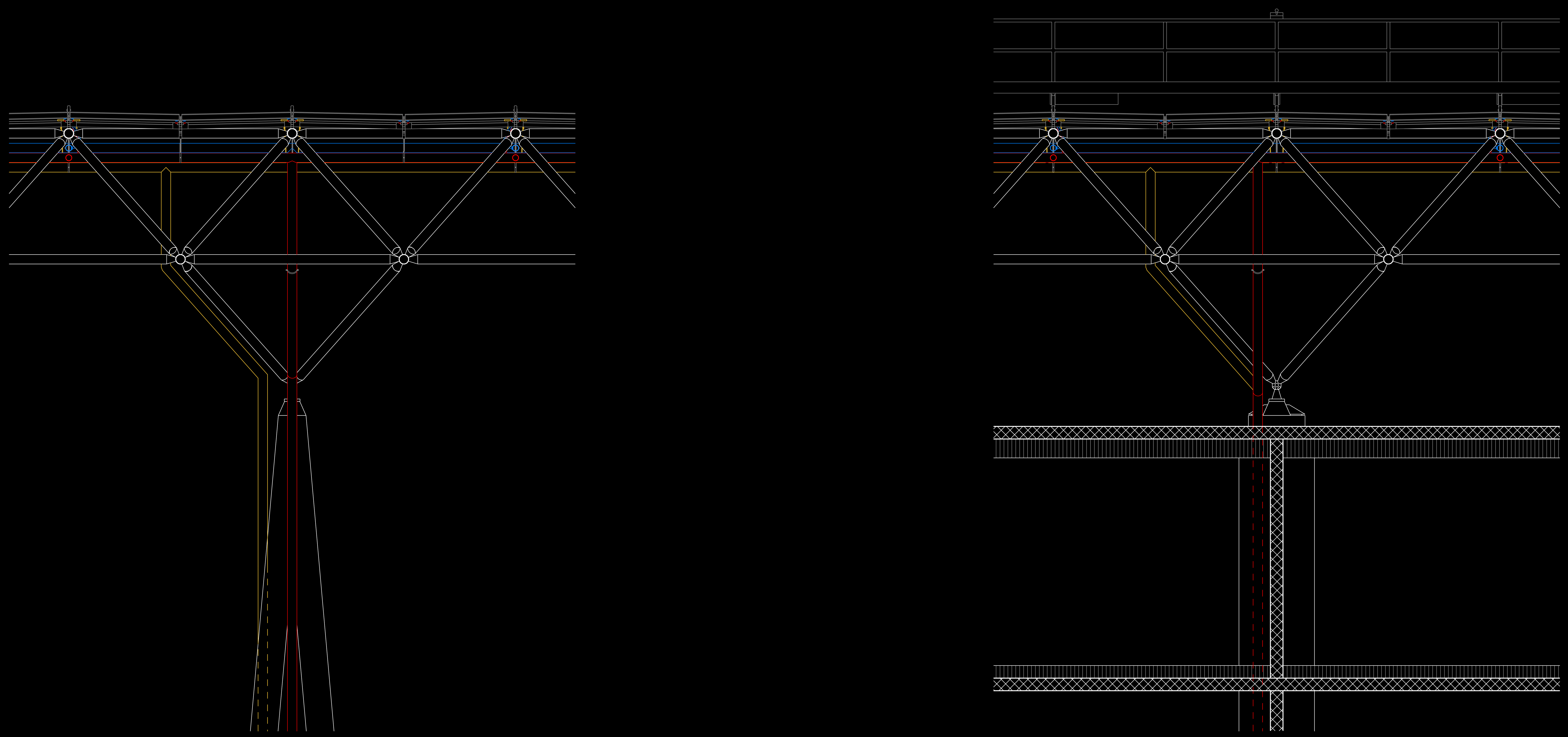
SOLAR COLLECTORS ARRAY



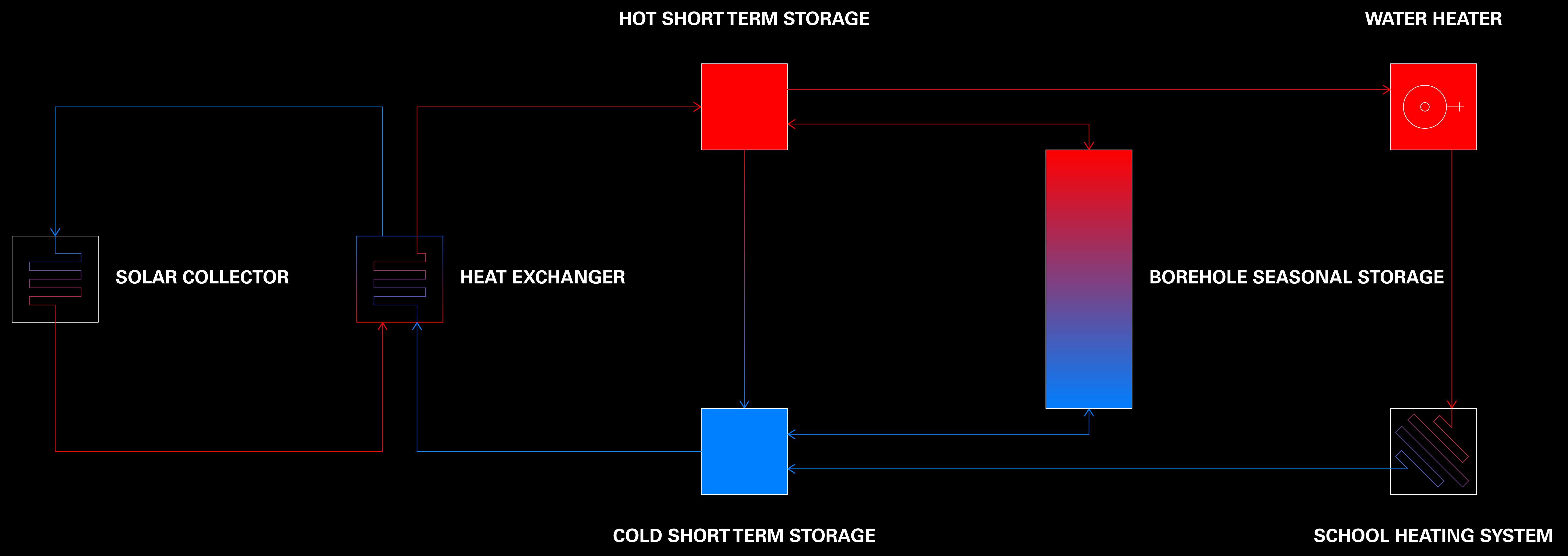




WEST VIEW

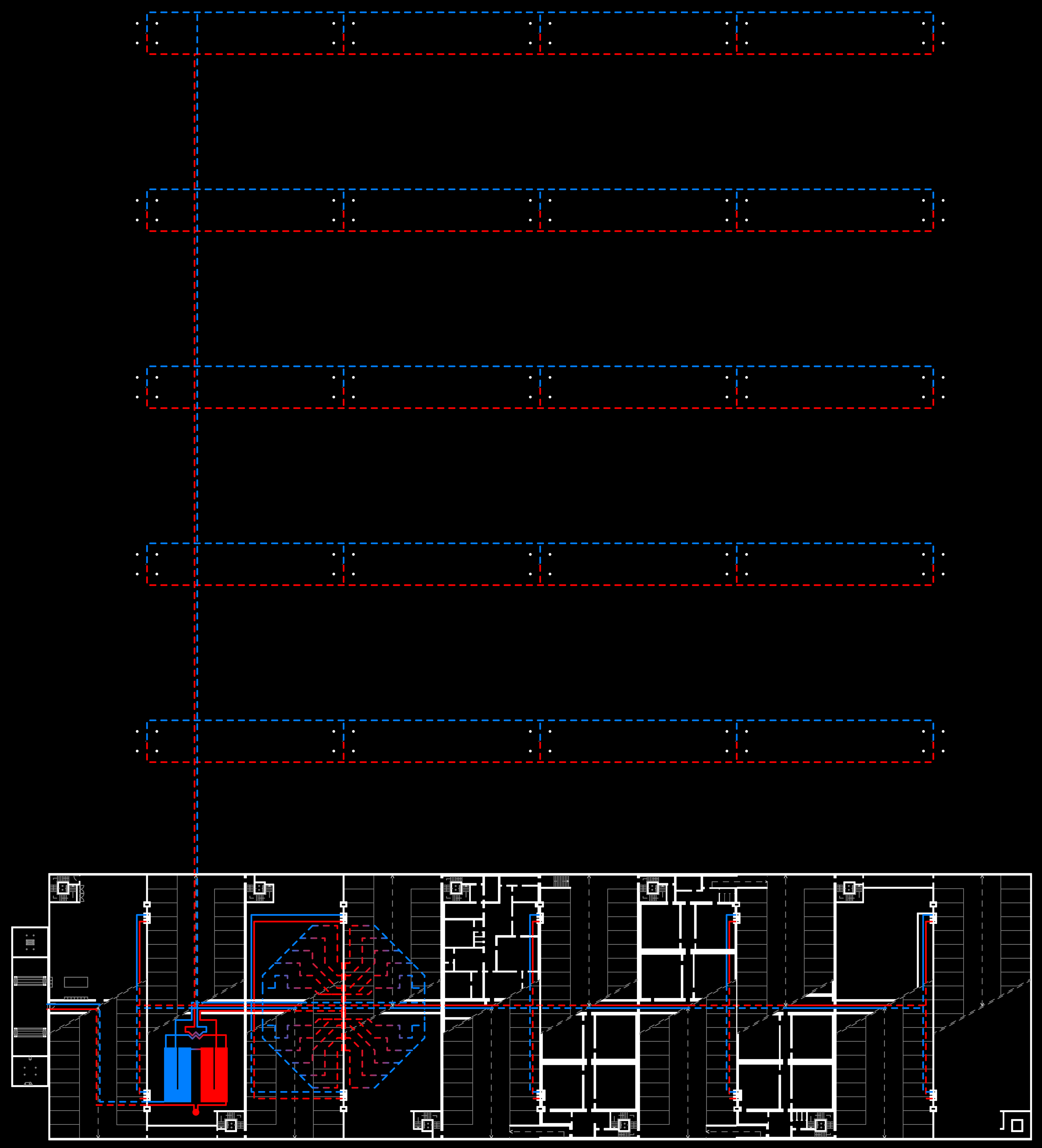


SOUTH VIEW

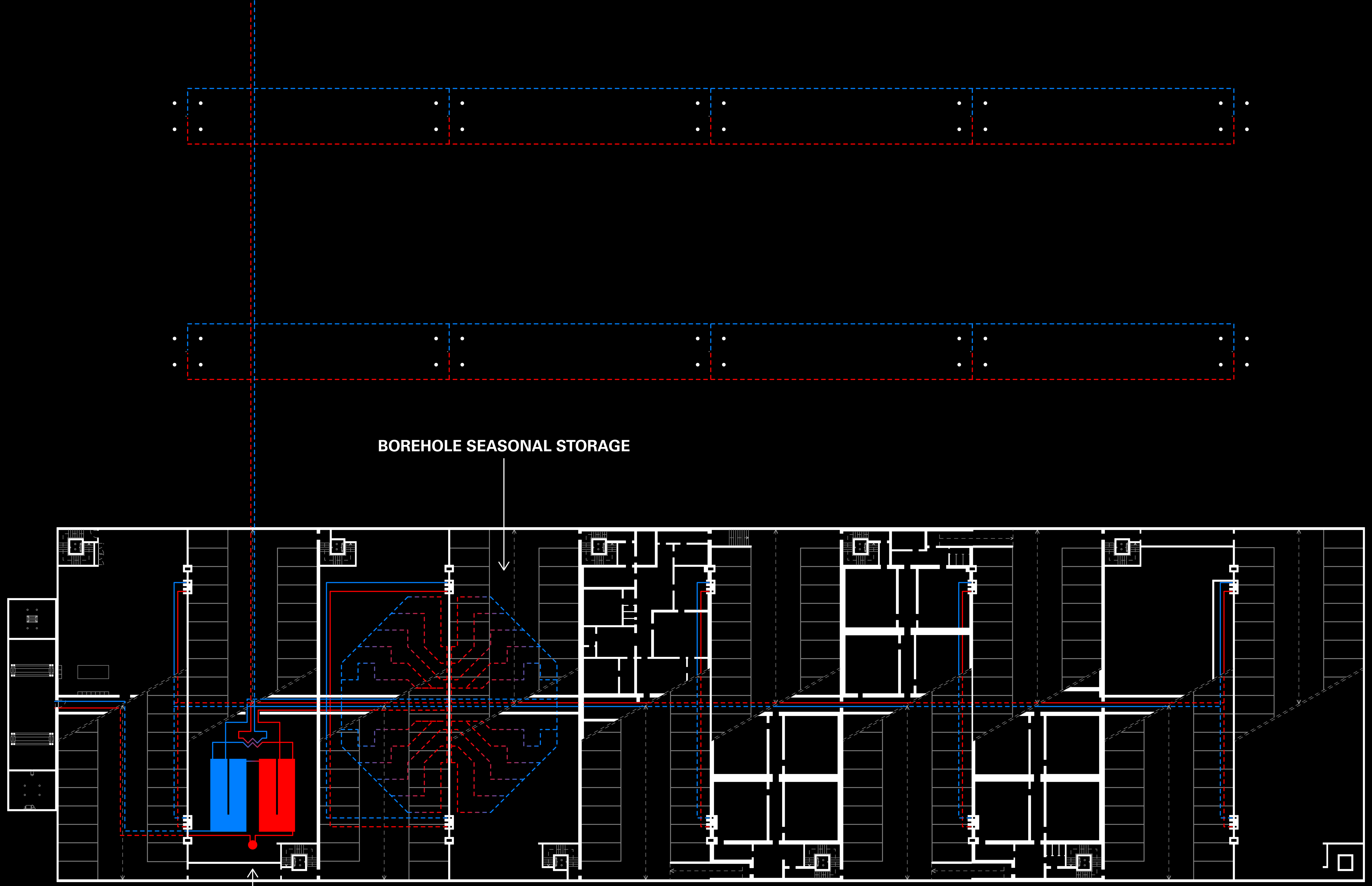


THERMAL CIRCUIT DIAGRAM

COOLANT ROUTE



COOLANT ROUTE

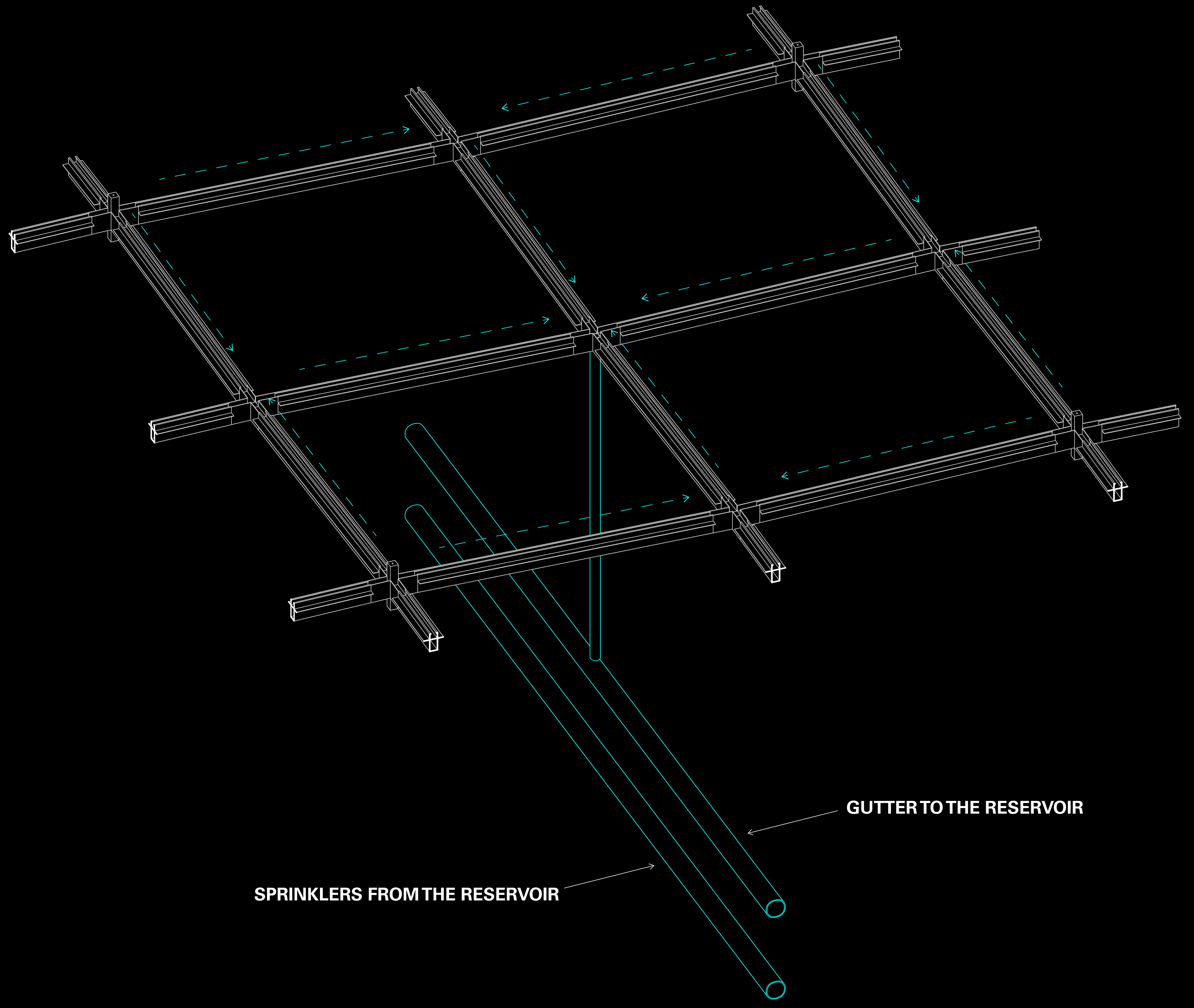


COOLANT ROUTE

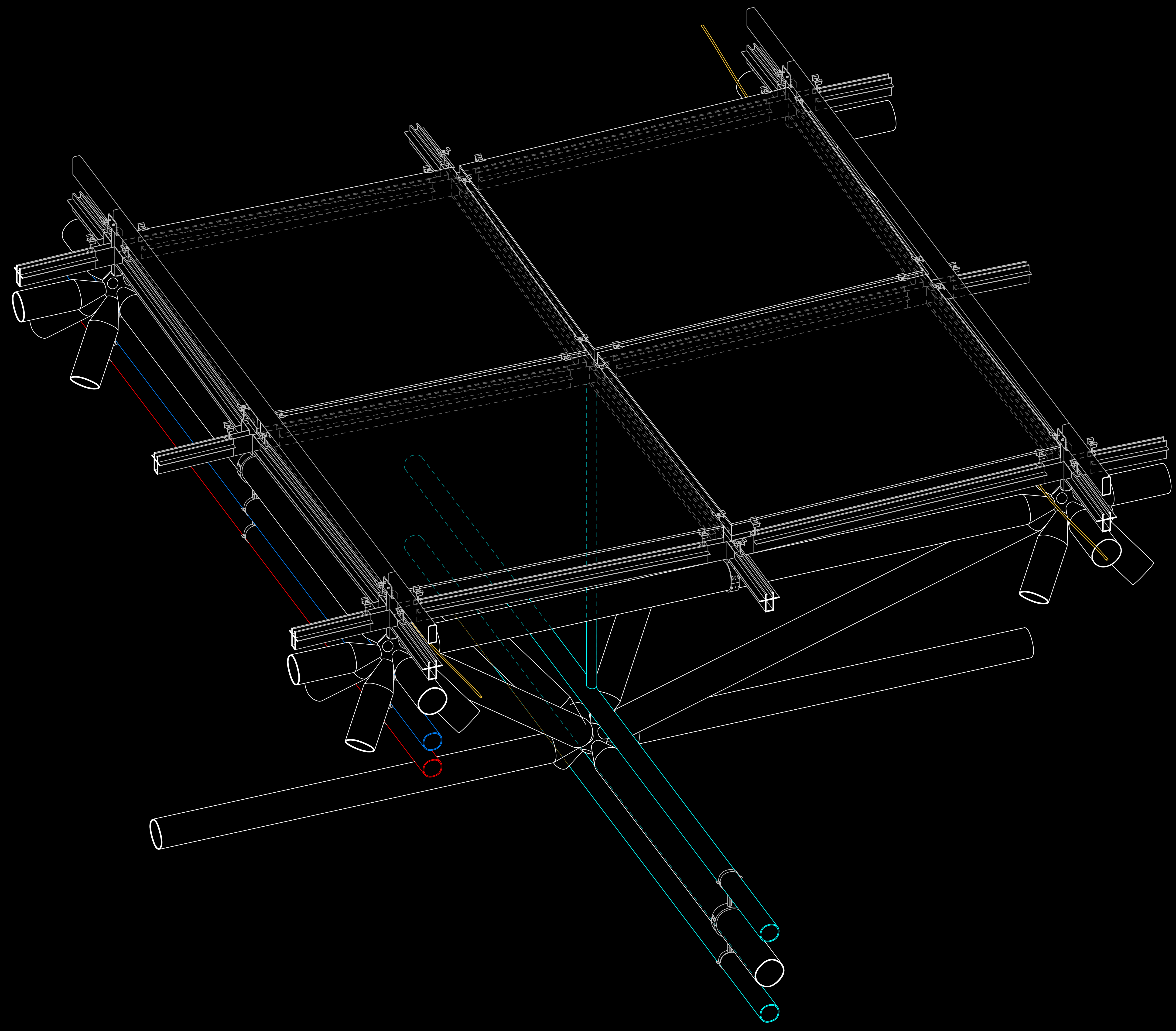
e

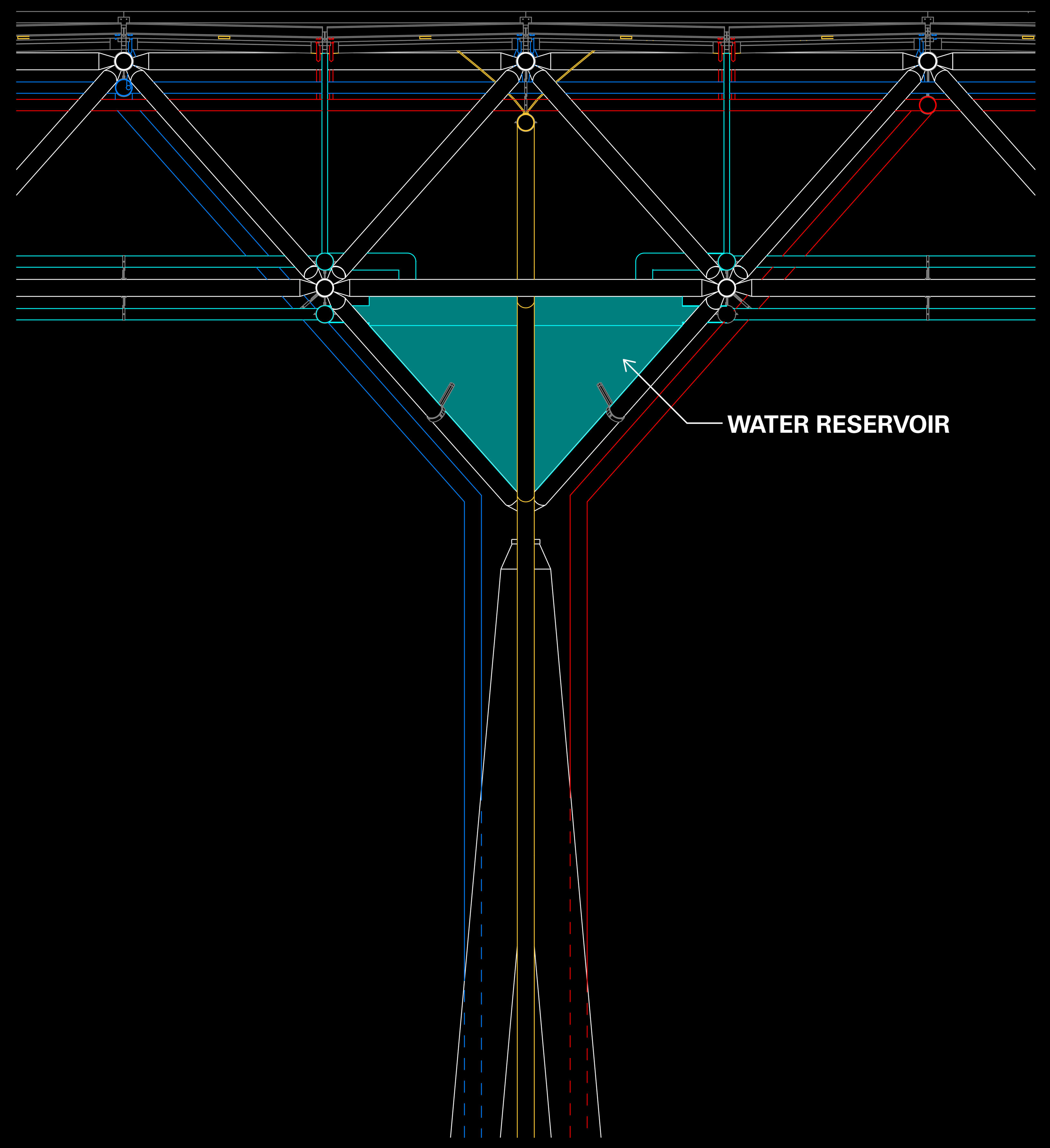
WATER CAPTION AND IRRIGATION

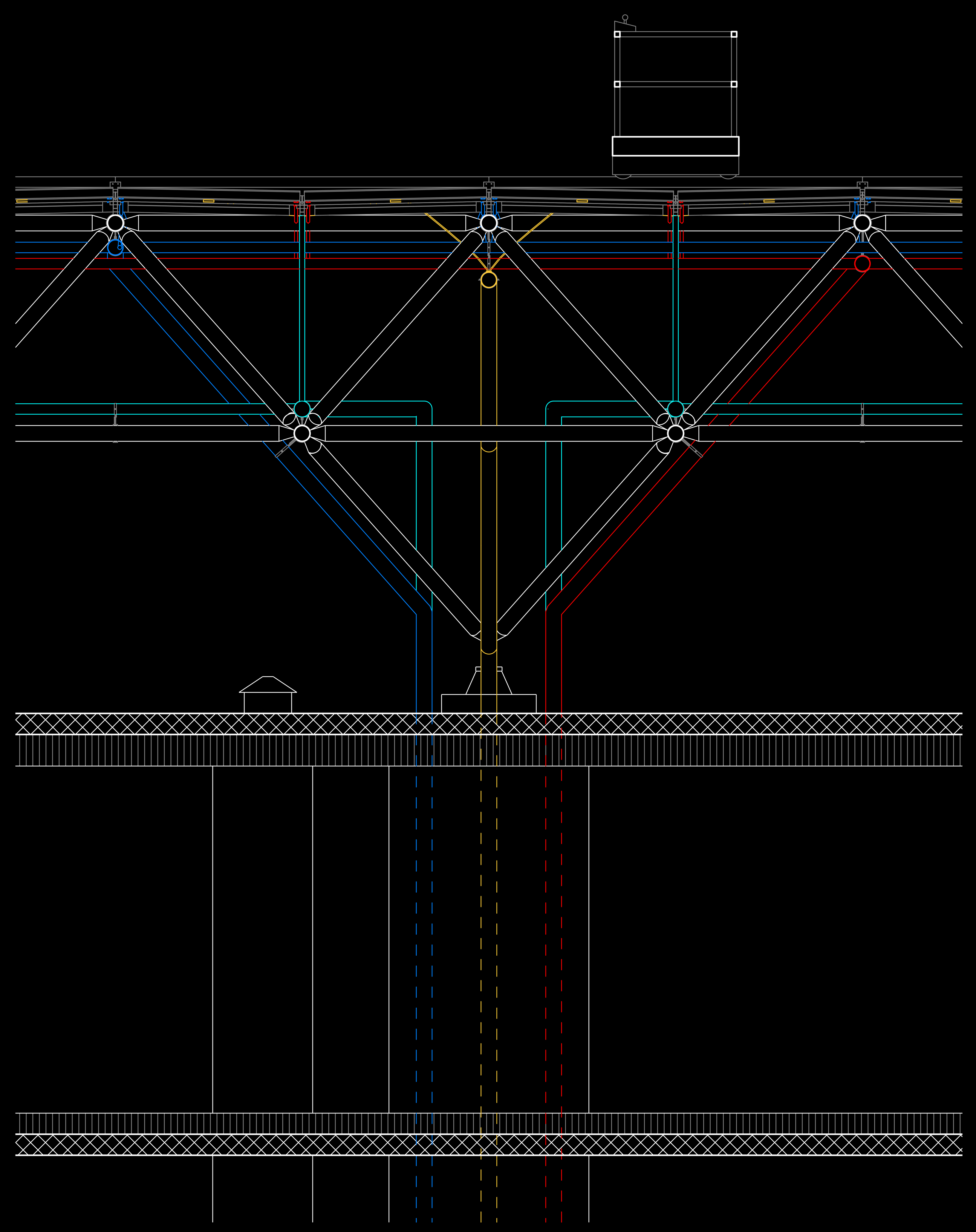
Rainwater is captured and stored in tanks placed above the vertical supports, and is used to water the park at night. The drainage starts from the rails that supports the panels, which have an integrated gutter in their profile. The tanks are also connected to the city water system, in order to ensure that the water needs of the plants are also met in dry periods.



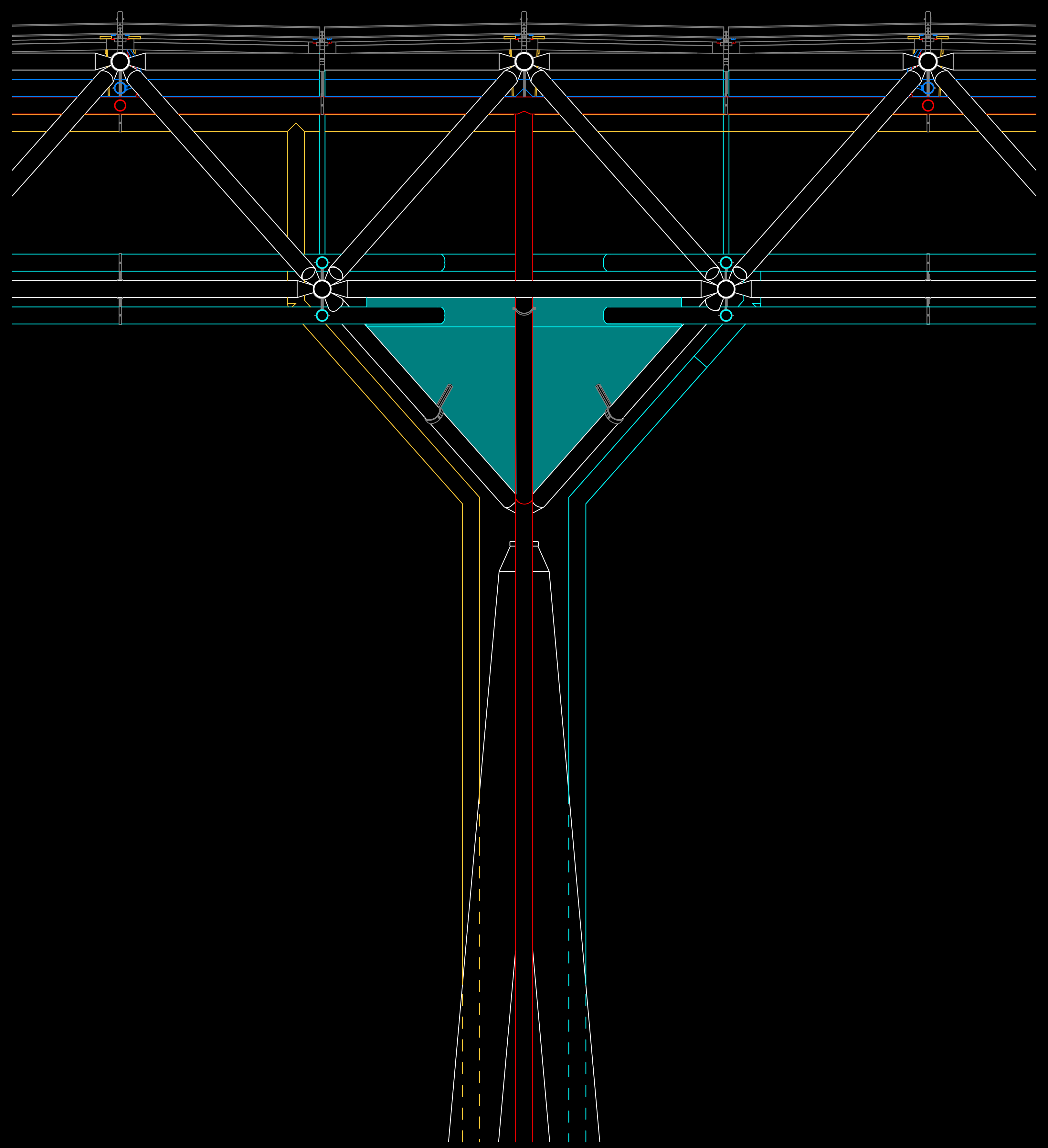
DRAINAGE AND IRRIGATION

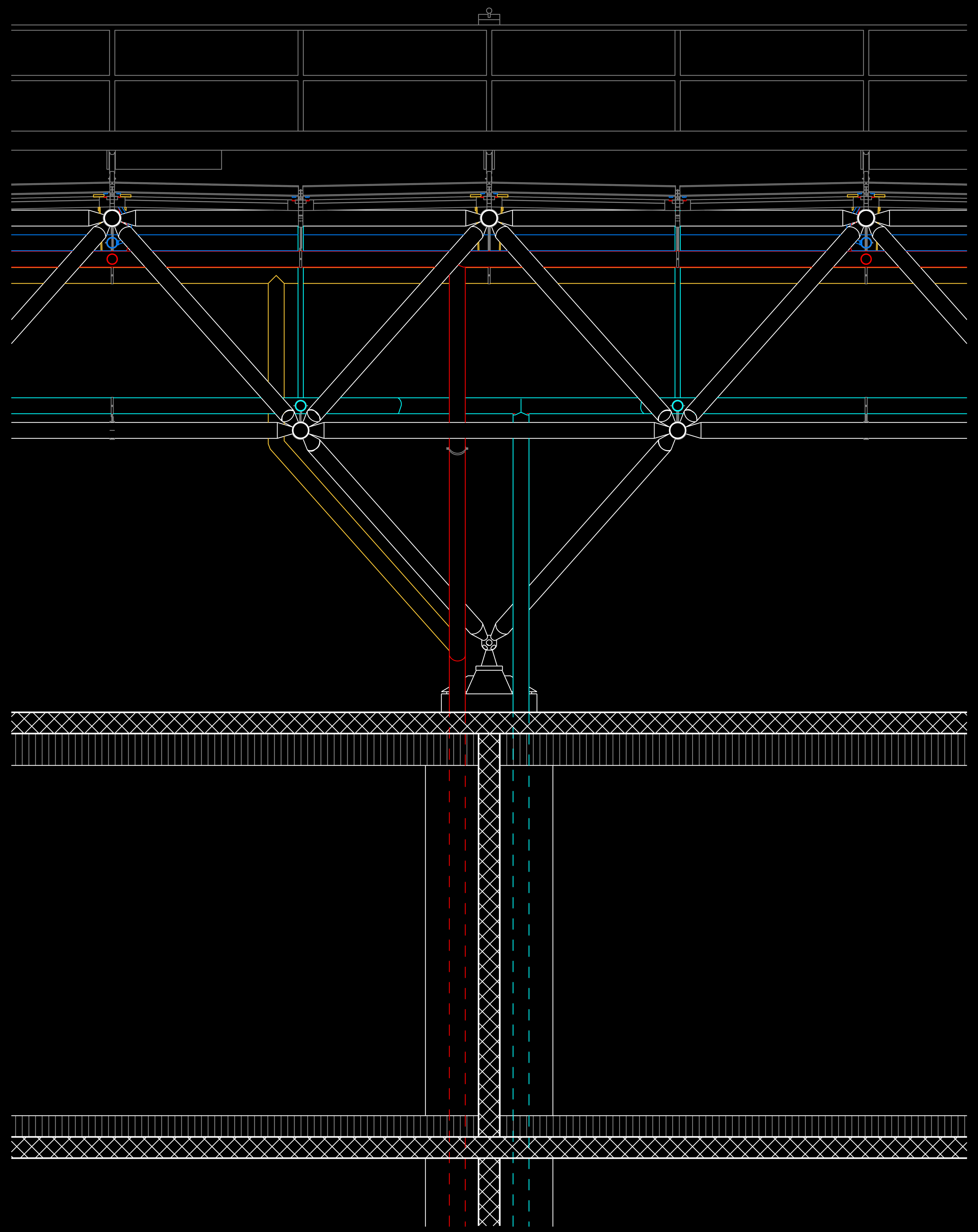






WEST VIEW





SOUTH VIEW

IV

THE PARC

The Horburgpark was once the cemetery of the city and the site of the first crematory. Few traces remain of its rigorous and elegant design, particularly the tree-lined path that serves as the main route.
Multiple activities are scattered throughout the park in what appears to be a design with no precise intentions. These considerations, in conjunction with the new photovoltaic roofing, have inspired the redesign of the park, in an effort to restore the order that characterized it and offer new opportunities for recreation to the future district of Klybeck.

HORBURGPARK 1933


HORBURGPARK 2020


PATHWAYS


ORIGINAL TREES

HARD SURFACES


SOCCER
SKATEPARK
SLIDES
PING PONG
BASKETBALL
PUMPTRACK
PLAYGROUND
POOL

ACTIVITIES

NEW ACTIVITIES


HARD SURFACES


CONTOUR TREES


PATHWAYS

CLICK HERE TO GO TO THE MOVIE